



# A SUSTAINABLE HOME IMPROVEMENT GUIDE FOR THE CITY OF RICHFIELD



**ESPM 4041W Problem Solving for Environmental Change**  
**Report 7/9 Prepared for:**  
**The City of Richfield**

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## Executive Summary

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In collaboration with the City of Richfield, the Problem Solving for Environmental Change students at the University of Minnesota created a “Sustainable Home Improvements” guidebook to promote sustainable alternatives for residential homeowners. All recommended measures in the guidebook are consistent with the U.S. Environmental Protection Agency’s definition of sustainability.

“Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations” (EPA.gov).

By using this definition as a goal, we were able to identify many products, methods, and technologies that would help Richfield achieve sustainability.

Home improvements were chosen based on a variety of criteria, including cost effectiveness, commonly used and readily available, and whether the improvements are easy to implement. Other home improvements that might not meet these criteria were added at the request of our contact because there are new or novel and have particular interest to residents of the City of Richfield. Online sources and published books provided information for choosing which improvements would be focused on in this guidebook. Reliability of these sources was confirmed using cross-referencing.

More than 90 pages of information on green and sustainable improvements are provided in the Guidebook for homeowners to consider. They include actions for inside and outside the home. We recommend that the City of Richfield make this material available to residents its website and in a loose-leaf format, so that homeowners without Internet access can copy relevant pages. All material should be reviewed at least annually because improvements in green and sustainable technology are advancing at a rapid rate.

# Introduction

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The Comprehensive Plan for the City of Richfield expresses the overarching desire to create “development that accommodates present needs without compromising the ability of future generations to meet their own needs.” This is especially challenging in Richfield because the city is largely developed, with construction of most residential areas dating back to the 1940s and 1950s, before “green” architecture and green construction materials were in vogue. For this reason, the focus of most residential construction in Richfield comes in the form of home renovations. Richfield City administrators believe that residents could benefit from guidance on how to renovate with sustainability in mind. This report describes the process we used to create a user-friendly guide for sustainable renovation of existing homes in Richfield, Minnesota.

## Goals and Objectives

The main goal of the “Sustainable Home Improvements” guide is to parallel Richfield’s Comprehensive Plan in implementing sustainable development for residential homes. Our research describes alternatives and home improvement options for homeowners. The guidebook will inform residents of existing and emerging technologies and methods designed to create more efficient and sustainable homes and landscapes. For items with reliable information on costs, the guidebook will outline approximate purchase prices and installation costs. There will also be brief explanations on how those costs may be returned to the homeowner over time through lower energy bills, reduced household maintenance and reduced garbage collection fees, and other means. To give the homeowner an idea of which projects will meet their short- and long-term budgets, the guidebook will estimate the length of payback for individual items. In sum, the guidebook will assist homeowners in making well-informed decisions when designing a residential renovation project, or if they just want to replace a broken appliance or find simple ways to improve energy efficiency.

## Class Vision

Environmental Sciences, Policy, and Management students from the University of Minnesota will provide the City of Richfield with resources and recommendations to develop progressive, long-term solutions to community issues in efficient, ethical, and sustainable ways.

## Group Vision

The City of Richfield foresees the importance of valuing our natural resources now so they will be available for future generations. Our vision is to create a guidebook that will provide a foundation for Richfield homeowners who desire more sustainable homes and landscapes. In turn, this will reduce environmental impacts as well as introduce homeowners to potential benefits, such as reducing utility payments and minimizing home maintenance costs. When communities are informed about the importance of sustainable home renovations, minor changes made by individuals in the community can have immense positive impacts on the area as a whole.

## Site Description

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The site description for this project includes the City of Richfield's residential neighborhoods. More specifically, it targets Richfield homeowners interested in sustainable home and landscape renovations. As reported by Richfield city administration, two housing styles have comprised the majority of the city; the "Cod Cottage" and the "Three-bedroom Rambler." In addition, the City of Richfield is not experiencing an increase in brand-new home building, causing specific home and landscape renovations to be the objective of the guidebook. The focus of the project site includes residential yards and driveways, as well as interiors (including appliances, flooring, heating, water, and paint) and exteriors of pre-existing homes (including the entire outdoor premises of the individual home owner).

## Methods

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The Sustainable Home Improvement Guide looks to provide an introduction on the benefits of implementing sustainable changes within the home with the most current information available. By providing a working definition of sustainability, choosing the most accurate home improvements for Richfield's desires, relying on credible sources for information and using an appropriate formatting style, we are able to present a reliable and user-friendly guide to the City of Richfield.

## Sustainability Definition

We wanted to provide a clear definition that will be able to represent the term *sustainable* as a beneficial and realistic alternative to conventional practices, especially in relation to home improvements. Ensuring it is presented to reach diverse audiences, it was important that those with or without previous experience with the term could easily understand its definition. The guide's definition of sustainability will help increase homeowner interest by focusing on the economic and environmental benefits sustainability can offer.

Sustainability can be defined in a variety of ways depending on contexts. While researching the definition we used an array of credible resources so as to best tailor the word to fit our focus of home renovation sustainability. Included in these sources were the National Parks Service (NPS), the Environmental Protection Agency (EPA), the United Nations and the United States Department of Agriculture (USDA). We also used two dictionary definitions, found in the Merriam-Webster and Oxford print. These various definitions acted as guidelines for presenting our definition.

## Selecting Sustainable Improvement Options

The Sustainable Home Improvement guide looks to provide various alternatives to conventional home improvements that will benefit individuals and communities within the City of Richfield. There currently are hundreds of options for sustainable home improvements. Because of this, we narrowed the scope of the guide to those meeting criteria the Richfield city administration had created:

1. Most common and most available.
2. Easily implemented or manageable.
3. Most cost effective or fast economic return.

After compiling the information, the guidebook was split into four sections to provide the audience diverse ideas in sustainable home improvement. These four sections are listed below.

1. Energy Efficiency
2. Sustainable Supplies and Products
3. Sustainable Landscaping
4. Water Conservation

Information on these home improvements was derived from reputable online and text sources. Through cross-referencing of these sources, we trust the extracted data is both reliable and up-to-date. These sources include: Energy Star, Xcel Energy, Alliant Energy, United States Department of Energy (U.S. DOE), EPA, Minnesota Pollution and Control Agency (MPCA), National Renewable Energy Lab, and Hennepin County. Additional information was taken from the book *Green Home Improvements* (Chiras 2008).

After collecting the data from these sources we gathered information on sustainability practices from other Twin Cities suburbs to get a sense for what is important to nearby communities. These communities include the cities of Burnsville, Roseville, Maplewood, and St. Louis Park. The “green guides” these cities offer are presented to similar demographics and accommodate the criteria the City of Richfield is looking for in its own guide. This information was used for the Sustainable Landscapes portion of the guide.

## Formatting

We produced a user-friendly guide that will be posted on the web and can be easily updated and released in printed form upon request. The format for the guide was chosen based upon its usability; whether the guide is easy to follow, informative and understood by diverse audiences with ranges in knowledge of sustainable home improvements. The guide is portioned by the four subsections, where each subsection will include a brief description of the home improvement item or idea, the benefits and costs of the item or idea, additional tips or helpful hints and references for further information.

## Discussion

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### Results

Using the previously described methodology to gather all necessary information, the results yield a list of the home improvement options that were found to be the most suitable. The foundation for all research and information was based on sustainability of pre-existing homes in the City of Richfield. The chosen definition of sustainability that is most accustomed to this project was acquired from the EPA:

“Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations”  
(EPA.gov).

The sustainable options best fit for Richfield, MN, are listed below. These are the items contained in the guidebook.

1. Sustainable Landscaping
  - a. Native Species
  - b. Shade Trees
  - c. Rain Gardens
  - d. Rain Barrels
  - e. Composting
  - f. Permeable Surfaces
  - g. Mulching
  - h. Green Roofs
2. Residential Structural Home Improvements
  - a. Energy Efficiency
    - i. Power Strips
    - ii. Purchasing Green Power
    - iii. Timers and Motion Sensor Light Switches
    - iv. Programmable Thermostats
    - v. Solar Panels
    - vi. Wind Turbines
    - vii. Appliances
      - (1) Refrigerators
      - (2) Dishwashers
      - (3) Washing Machine
    - viii. Geothermal
    - ix. Furnaces
      - (1) Furnace Replacement
      - (2) Furnace Tune-Up
    - x. Alternative Heat
      - (1) Pellet Stove
    - xi. Insulation, Sealing Ducts, and Leaks
      - (1) Spray Foam, Caulk, and Weather Stripping
      - (2) Insulation Spray-Foam, Cellulose, Rigid Foam Board, Fiberglass
      - (3) Duct Sealing

- xii. Lightbulbs
  - (1) Compact Fluorescent Lightbulbs
- xiii. Doors and Windows
  - (1) Garage Doors
  - (2) Front/side/back Doors
  - (3) Windows
- xiv. Outlets and Fireplaces
  - (1) Outlet Insulation and Cover
  - (2) Fireplaces
- b. Water Conservation
  - i. Flushing your water heater to remove sediment
  - ii. Water Heater Blanket and Pipe Insulation
  - iii. Adjusting Water Heater Temperature
  - iv. Water Heater Anode Rod Replacement
  - v. Tankless Water Heater (TWH)
  - vi. Solar Hot-Water Systems
  - vii. Faucet Aerators
  - viii. Water-Efficient Shower Heads
  - ix. Water-Efficient Toilets
- c. Sustainable Building Supplies and Products
  - i. Green Flooring Options
    - (1) Wood
      - (a) Reclaimed or Salvaged Wood
    - (2) Non-Wwood
      - (a) Bamboo
      - (b) Cork
    - (3) Natural Linoleum
      - (a) Tile: Recycled Content Tile
    - (4) Green Carpeting
      - (a) Recycled Content Carpet
      - (b) Wool Carpet
  - ii. Green Paints, Stains, and Finishes
    - (1) Non-VOC paints

The final piece of this project was putting the information together in a guidebook format. To ensure readability and consistency, each section of the guidebook follows this formatting:

## Sustainable Home Improvement Guide

Intro: definition of sustainability

1. **CATEGORY** (bold font\*\*...)
  - a. brief introduction/explanation
    - i. Subcategory
      1. brief definition/explanation etc.
        - a. Benefits
          -
        - a. Costs
          -
        - a. Tips
          -
        - a. References (specific to this subcategory)
          -

The use of bold font, italics, underlining, and bullet points make it easy to read and find information, as opposed to lengthy paragraphs that can become overwhelming and difficult to follow. In addition, for certain subcategories, tables explain cost information or other key facts that may be important to users of the guidebook. The goal is to make the guide as visually appealing and accessible as possible. Because of possible copyright infringement issues, pictures are not used except where necessary to illustrate a concept.

## Recommendations

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The following table (Table 1) lists the top three sustainable home improvement projects from each main category with which the following criteria was followed: most commonly available, easily implemented, and most economical. These are examples of actions and products recommended to Richfield residents who are interested in moving toward more sustainable households.

There were some thresholds that were difficult to establish and/or hold constant as far as price or actual quantitative costs are concerned. One of the realities is that prices fluctuate. The website resources such as the EPA, MPCA, U.S. DOE, along with the EnergyStar branch of the EPA website are assumed and expected to be regularly updated. Providing and citing these resources within the guide is an approach to keeping the information updated and available to Richfield residents after final publication of the guidebook.

**Table 1.** Most common, easily implemented, and cost-effective sustainable home improvements.

<b>Sustainable Landscaping</b>	<b>Benefits</b>
1. Native species and management	Reduced cost in management, enhances water and air quality, increased aesthetics and habitat
2. Rain barrels	Reduce cost of water use, reduce waste water runoff
3. Composting	Reduce waste, reduce cost for fertilizers, educational experience
<b>Sustainable Indoor Improvements</b>	
<i>Energy efficiency</i>	
1. Appliances	Can save families, on average, one-third on their energy bills with similar savings on greenhouse gas emissions (energystar.gov)
2. Power strips	About 75% of energy used in the home is used by appliances that are “off.” You can reduce this effect by using power strips for appliances and electronics in your home (USDOE).
3. Programmable thermostats	By setting the temperature higher or lower when you are not home, you can save money on your heating and cooling bills as well as reduce your CO <sub>2</sub> emissions.
<i>Water conservation</i>	
1. Flushing your water heater to remove sediment	Reduces amount of energy needed to heat water
2. Water heater blanket and pipe insulation	Reduce heat losses between 25% to 45%. Reduce energy costs.
3. Water-efficient shower heads/toilets	Reduces water consumption
<i>Products &amp; supplies</i>	
1. Wood flooring: Reclaimed/salvaged wood or FSC (Forest Stewardship Council) certified products	Reclaimed wood is sustainable and conservative, long lasting flooring option
2. Recycled content tile flooring	Long lasting, unique and durable, easy to clean and healthy—does not harbor dust, spores and allergens
3. Green or non-VOC paint, stains and finishes	Reduces indoor air pollution; safer indoor environment and healthier indoor air quality

Ideally, we would like to recommend a specific period for routine updates. However, the reality is that prices fluctuate at unpredictable and irregular intervals, and technologies come and go from the market without warning. We therefore recommend that these pages be reviewed and updated on an annual basis. Not all pages will need updating, but those that do will only be outdated for months instead of years, if reviews are conducted annually.

None of the information is primary data, and all the secondary sources were double checked for reliability. County, state, and national websites are assumed to be more up to date than books published prior to the publication of the guidebook. We expect major website providers such as the EPA, EnergyStar, and MPCA to continue growing with informative content, as they have over the past decade; therefore, by providing links to these sites and to additional resources from credible websites, Richfield residents have information they need to reanalyzing the information in the guide.

Our final recommendation is that the information in the attached guidebook be made available to Richfield residents on the internet and in loose-leaf notebook form at city offices where residents without computers can browse the guide and copy specific pages.

## **Conclusions**

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Many products are on the market to help homeowners achieve more sustainable lifestyles and the information in the Sustainable Home Improvement guide we have provided to the City of Richfield will help homeowners discover new approaches to home renovation, energy efficiency, and sustainability. The guide contains only the most easily implemented and cost effective measures, so residents will need to spend less time sorting through the myriads of information available on the internet and other locations. Fulfilling the client's requests to the best of our abilities, the Richfield Sustainable Home Improvement Guide is now ready for publication in hard and electronic copies to help promote the sustainable future of the Twin Cities' outstanding first suburb.

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UNIVERSITY OF MINNESOTA – TWIN CITIES

# Sustainable Home Improvements Guide

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Richfield, MN

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# Sustainable Home Improvement Guide

## Richfield, MN

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## **Introduction**

When making improvements to your home, consider implementing sustainable alternatives. Sustainability, as defined by the Environmental Protection Agency, “creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.” These green alternatives perform the same functions as conventional ones but offer much more. Whether it is putting in a new floor, planting a new garden, or updating your bathroom, there is a green alternative that will help reduce the impact on the planet and help you some money. The Sustainable Home Improvement Guide provides information on a few ways to save money, time, and help protect the planet.

This guide was compiled by Abigail Brown, Zachary Dowd, Grace Giampietro, Katherine Lind-Orina, and Emily Schneider; a group of students in the Fall 2011 Problem Solving for Environmental Change course at the University of Minnesota -- College of Food, Agriculture and Natural Resource Sciences.

*\*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this guide, and the ones listed here are merely suggestions. \**

## **RESIDENTIAL STRUCTURAL HOME IMPROVEMENTS**

This section of the guide covers projects, products, supplies and other sustainable home improvements that take place indoors. In-home sustainability incorporates three very important aspects: energy efficiency, water conservation, and safe products. Sustainability can be approached at varying degrees and in various areas. The following categories and subsections outline the most readily available, cost efficient and most manageable improvement projects. These improvement projects provide a baseline for any resident in Richfield to begin their quest for a more efficient and conservative lifestyle, while protecting the natural environment for future generations.

**This section includes:**

1. Green Disposal & Materials Recycling
2. List of Home Improvement Stores in Richfield
3. Energy Efficiency
4. Water Conservation
5. Sustainable Home Products & Supplies

## Green Disposal and Materials Recycling

These are many options available in the Twin Cities area for sustainable disposal of unwanted items, still usable materials, and/or recycling. Following are some examples of locations where drop-offs of unwanted materials are welcome and you may shop for salvageable materials. These are just some options, please do some online searching for yourself; you may be about to find a location that better meets your specific needs.<sup>1</sup> Some certain items have small fees along with recycling or disposing of the items, please contact the location(s) with your specific questions or visit their website(s).

- Green Lights Recycling
  - *Provides recycling services* for fluorescent lights, ballast, computers, electronics, batteries, and mercury containing devices
  - *Location:*
    - 10040 Davenport Street NE, Blaine, MN 55449
    - Phone: (763) 785-0456 or Fax: (763) 785-0453
  - *Hours of operation:*
    - M-F 7:30 a.m. - 4:00 p.m.
  - *Brochure:* <http://www.greenlightsrecycling.com/GLR%20Flyer.pdf>
  - *Website:* <http://www.greenlightsrecycling.com/>
- Carver County Environmental Center
  - *Recycling & Household Waste Management:*
    - Materials accepted: household hazardous waste, recyclables, organics, batteries, carpeting, cartridges, clothing/useable products, use motor oil/oil filters/antifreeze, appliances, fluorescent bulbs, residential & business electronics, scrap metal, tires, yard waste
  - *Location:*
    - 116 Peavey Circle, Chaska MN 55318
    - (952) 361-1835 or (952) 361-1800
  - *Hours of operation:*
    - Summer hours: April – November
      - Wednesday: 12 - 7 p.m.
      - Thursday: 12 - 6 p.m.

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<sup>1</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

- Friday: 10 a.m. – 4 p.m.
  - Saturday: 8 a.m. – 12 p.m.
- Winter hours: December-March
    - Wednesday: 12 – 7 p.m.
    - Thursday: 11 a.m. – 5 p.m.
    - Saturday: 8 a.m. – 12 p.m.
- *Brochure:*
  - <http://www.co.carver.mn.us/departments/LWS/docs/ECBrochure.pdf>
- *Website:*
  - <http://www.co.carver.mn.us/departments/LWS/env-svc/envirocenter.asp>
- Hennepin County Drop-Off Facilities
  - *Recycling, household hazardous waste & trash disposal:*
    - Material accepted: electronics (T.V.'s, stereos DVD/VCRs, etc.), appliances, household hazardous wastes, trash, automotive products, household products, lawn & garden products, tires, and metal, paper/cardboard, plastics, and holiday lights recycling
  - *Locations:*
    - Brooklyn Park:
      - Hennepin County Recycling Center and Transfer Station
      - 8100 Jefferson Highway, Brooklyn Park, MN 55445
    - Bloomington:
      - South Hennepin Recycling and Problem Waste Drop-Off Center
      - 1400 West 96th Street, Bloomington, MN 55431
  - *Disposal information:*
    - “A to Z How-to-Get-Rid-of-It Guide” for households and businesses
      - <http://www.co.hennepin.mn.us/portal/site/HennepinUS/meanitem.b1ab75471750e40fa01dfb47ccf06498/?vgnextoid=6007d0e2971f3210VgnVCM20000048114689RCRD>
    - Or Call:
      - (612) 348-3777
  - *Hours of operation*
    - Monday: Closed
    - Tuesday, Thursday, Friday: 10 a.m. - 6 p.m.
    - Wednesday: 10 a.m. - 8 p.m.

- Saturday: 8 a.m. – 5 p.m.
- Sunday: Closed
- *Brochure:*  
[http://www.co.hennepin.mn.us/files/HennepinUS/Environmental%20Services/Drop-off%20Facilities%20and%20Events/Drop-off%20Facilities/DropOff\\_06\\_2011.pdf](http://www.co.hennepin.mn.us/files/HennepinUS/Environmental%20Services/Drop-off%20Facilities%20and%20Events/Drop-off%20Facilities/DropOff_06_2011.pdf)
- *Website:*
  - <http://www.co.hennepin.mn.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnextoid=3291aefe1c083210VgnVCM10000049114689RCRD>

### **Reusing Salvaged & Surplus Materials**

Large varieties of products are readily available and can be located, including: floor tile, granite, marble, brick, timber, windows, doors and door frames, bathroom (toilet and sinks) fixtures, cabinets, and hardware, etc.<sup>2</sup>

- **Habitat for Humanity ReStore**
  - *Find materials here:*
    - Building materials, sinks, toilets, doors, cabinetry, wood, furniture, tiling, and much more
    - Availability varies with each ReStore
  - *Accepted donations:*
    - Must contact the location for specific qualifications of items and times to drop-off or schedule pick-up
  - *Numerous & various locations in the Twin Cities:*
    - [http://www.habitat.org/cd/env/restore\\_detail.aspx?place=56](http://www.habitat.org/cd/env/restore_detail.aspx?place=56)
      - 510 County Rd D West, New Brighton, MN 55112
        - Phone: (612) 588-3820
      - 501 West Broadway Ave., Minneapolis, MN
        - Phone: (612) 588-3820
  - *Website:*
    - <http://www.tchabitat.org/restore>

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- Minnesota Materials Exchange
  - *Services:*
    - “A free service that links organizations that have reusable goods they no longer need to those who can use them.<sup>3</sup>”
  - *Location:*
    - 200 Oak St SE Suite 350, Minneapolis MN 55455
    - Phone: (612) 624-1300 or (800) 247-0015
    - Fax: (612) 624-3370
  - *Website:*
    - <http://mnexchange.org/>
  
- The ReUse Center
  - *Accepted materials:*
    - Cabinets, doors, architecturally significant trim, millwork, windows, sinks, tubs, toilets, antique hardware, light fixtures of antiques, surplus (new) building materials, leaded glass or stained glass, large quantities of tile marble or stone
  - *Location:*
    - 1727 Highway 36 E., Maplewood, MN 55109
    - Phone: (651) 379-1280
  - *Hours of operation:*
    - Every day: 10 a.m. – 6 p.m.
  - *Websites:*
    - <http://www.thereusecenter.com/>
    - <http://www.greeninstitute.org/programs/reuse-deconstruction.htm>

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<sup>3</sup> Minnesota Material Exchange website, accessed 29 November 2011, <http://mnexchange.org/exchange/?content=about.us>.

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## List of Home Improvement Stores in Richfield

- The Home Depot
  - 6301 Richfield Pkwy., Richfield, MN
  - Phone: (612) 243-2400
  
- Menards
  - 7701 Nicollet Ave., Richfield, MN
  - (612) 798-0508
  
- Universal Windows Direct
  - 7610 Lyndale Ave. S. Suite 400 Richfield, MN
  - (612) 866-2888
  
- Bentley's Home-Work
  - 7015 Logan Ave. S., Richfield, MN
  - (612) 363-7319
  
- Sylvestre Construction Inc.
  - 7708 5<sup>th</sup> Ave. S., Richfield, MN
  - (612) 861-0188
  
- ParsleyBuilders
  - 2409 West 66<sup>th</sup> St., Richfield, MN
  - (612) 869-9100

*\*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \**

## **I. Energy Efficiency**

This section offers a wide range of options for ways to reduce energy consumption in your home. Benefits of reducing energy use include lower energy bills and a lower impact on the environment by reducing the amount of CO<sub>2</sub> and other greenhouse gases emitted into the atmosphere. Energy is a valuable entity that is created many times by nonrenewable resources such as coal. By reducing the amount of energy you use, you are reducing the strain on this natural resource and therefore living more sustainably.

### **This section includes:**

1. Power Strips
2. Timers & Motion Sensor Light Switches
3. Programmable Thermostats
4. Solar Panels
5. Wind Turbines
6. Appliances
  - a. Refrigerators
  - b. Dishwashers
  - c. Washing Machines
7. Geothermal
8. Furnace
  - a. Furnace Replacement
  - b. Furnace Tune-Up
9. Alternative Heating
  - a. Pellet Stove
10. Insulation, Sealing Ducts & Leaks
  - a. Spray foam, caulk & weather stripping
  - b. Insulation-spray foam, cellulose, rigid foam board, fiberglass
  - c. Duct Sealing
11. Light bulbs
  - a. Compact Fluorescent Light bulbs
12. Doors & Windows
  - a. Garage doors
  - b. Front/Side/Back doors
  - c. Windows
13. Outlets & Fireplaces
  - a. Outlet insulation & cover
  - b. Fireplaces

## 1. Power Strips

Phantom loads occur when an appliance is using energy even when the device is “off.” According to the USDOE, about 75% of energy used in the home is used by appliances that are “off.” You can reduce phantom loads by using power strips for appliances and electronics in your home.

### Benefits:

- *Cost Savings:* By using a power strip you can save significantly on your energy bills and lower your CO<sub>2</sub> emissions.

### Costs:

- *Purchase:* The cost of a power strip ranges from \$2.78-\$29.97 (TheHomeDepot.com)<sup>4</sup>.

### Tips:

- *By using a power strip* you can eliminate phantom loads by:
  - Plugging devices into power strips, and when not using them, turn the strip off.
  - *Unplugging devices* when they are not being used helps eliminate phantom loads
- *Additional information:* this handout explains phantom loads as well as, which appliances have the highest phantom loads, therefore, which appliances would benefit by being plugged into a power strip:
  - <http://alaskarenewableenergy.org/wp-content/uploads/2009/11/Phantom-Loads-Handout.pdf>.

### References

- “Energy Efficiency: Phantom Loads,” *Renewable Energy Alaska Project.*, accessed 5 November, 2011, <http://alaskarenewableenergy.org/wp-content/uploads/2009/11/Phantom-Loads-Handout.pdf>.
- The Home Depot, accessed on 6 November, 2011. [http://www.homedepot.com/webapp/wcs/stores/servlet/Search?keyword=power+strip&selectedCatgry=SEARCH+ALL&langId=-1&storeId=10051&catalogId=10053&Ntpc=1&Ntrp=1#/?c=1&Ns=P\\_RE\\_P\\_PRC\\_MODE|0&Nao=72](http://www.homedepot.com/webapp/wcs/stores/servlet/Search?keyword=power+strip&selectedCatgry=SEARCH+ALL&langId=-1&storeId=10051&catalogId=10053&Ntpc=1&Ntrp=1#/?c=1&Ns=P_RE_P_PRC_MODE|0&Nao=72).

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<sup>4</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 2. Purchasing Green Power

Green power comes in whole or in part from renewable energy sources. This could include wind, solar, geothermal, hydropower, and biomass sources.

### Benefits

- *Greenhouse Gases Reduced:* Many electricity providers offer the option of purchasing green power directly from them. By selecting this option, you reduce the amount of fossil fuels burned, and therefore lower your carbon footprint and the amount of CO<sub>2</sub> released into the atmosphere.

### Costs

- *Purchasing:* According to the Minnesota Pollution Control Agency, Minnesotans can buy small amounts of green power for \$1.50/month over regular costs, or 100% green power for \$6-\$14/month above the regular cost for energy (MPCA, 2011).

### Tips

- *More Information:*
  - *Brochure* on buying green power from the Minnesota Office of Environmental Assistance
    - <http://www.pca.state.mn.us/index.php/view-document.html?gid=4401>
  - *Where to buy* green power in the state of Minnesota
    - [http://apps3.eere.energy.gov/greenpower/buying/buying\\_power.shtml?state=MN](http://apps3.eere.energy.gov/greenpower/buying/buying_power.shtml?state=MN)

### References

- “Can I Buy Green Power In My State, Minnesota” *U.S. Department of Energy*. Published January 17, 2011. [http://apps3.eere.energy.gov/greenpower/buying/buying\\_power.shtml?state=MN](http://apps3.eere.energy.gov/greenpower/buying/buying_power.shtml?state=MN).
- “Buying Green Power” *U.S. Department of Energy*. Published December 1, 2010. <http://apps3.eere.energy.gov/greenpower/buying/>.
- “Buy Green Power” *Minnesota Pollution Control Agency*. Published May 16, 2011. <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/buying-green/buy-green-power.html>.

### 3. Timers and Motion Sensor Light Switches

#### Benefits

- *Control Energy Consumption:* Motion sensor light switches have the ability to turn lights in a room on and off based on if motion is detected in that room or not.
- *Save Money On Light bulbs:* By using a motion sensor you can reduce electricity use and extend the life of your light bulbs. Motion sensors are easy to install on you own.

#### Costs

- *Cost to purchase* ranges from \$14.95-\$44.99 (TheHomeDepot.com)<sup>5</sup>

#### Tips

- *How to install a motion sensor light switch:* (DIYnetwork.com)
  - Step 1: Turn off the power
  - Step 2: Test the wires, and remove the switch
  - Step 3: Cut the wires
  - Step 4: Strip the black and white wires
  - Step 5: Connect the wires to the new switch
  - Step 6: Tuck wires into the new box, and secure the switch
  - Step 7: Customize the controls, and re-install the wall-plate

#### References

- The Home Depot. Motion Sensor Light Switch Prices. Accessed on November 6, 2011. <http://www.homedepot.com>.
- “How to Install a Motion Sensor Light Switch”. *DIY Network*, accessed on 6 November, 2011, <http://www.diynetwork.com/how-to/how-to-install-a-motion-sensor-light-switch/index.html>.

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<sup>5</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 4. Programmable Thermostats

A common misconception among people is that by keeping the thermostat in their homes at a constant level, they are saving energy. This is false. Most homes only take 15 to 30 minutes to warm up or cool down, so by running the air conditioning or heat at a constant temperature all day, you are wasting a great deal of energy and money. Programmable thermostats monitor and control heating and cooling systems automatically based on your preferences. Home improvement centers and hardware stores carry a variety of programmable thermostats.

### **Benefits:**

- *Easy installation*
- *Reduce energy bills* by 10% or more per year if programmed correctly
  - Every degree a thermostat is set back over an eight-hour period reduces your heating bill by about 1%. Over time this amounts to great savings!
  - Can easily pay for itself within a year
- *Improves Air Quality:* Less pollution and greenhouse gasses released from power plants
- *Convenience:* You will no longer have to worry about adjusting the temperature when going to bed or leaving the house.
- *Less stress on your current heating and air conditioning equipment:* Because you are not heating and cooling quite as often, there will be less wear and tear which means maintenance, repair and replacement will not need to occur as frequently
- *Allows you to program your thermostat to the time of day and day of the week.* By setting the temperature either higher or lower than you would normally have it when you know you aren't going to be home during the day, you can save money on your heating and cooling bills as well as reduce your CO<sub>2</sub> emissions.

### **Costs:**

- *Purchase:* Ranges from \$50-\$250 depending on the features. Shop carefully, and for best performance consider choosing an Energy Star rated thermostat
  - Purchase price ranges from \$19.88-\$64.99 (TheHomeDepot.com)<sup>6</sup>

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<sup>6</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

**Tips:**

- *Do it yourself installation:* refer to Lowes.com
  - Turn off the power supply to the thermostat.
  - Remove the old thermostat, including the wall plate. Older thermostats with glass tubes contain mercury. Use caution when handling and check with your local recycling company for disposal instructions.
  - Label the wires on your system, noting where they were attached on the old thermostat. Ignore the wire color; use only letter designations to identify the wire types. Secure the wires (tie into a loop or tape them to the wall) to keep them from falling back into the wall.
  - Install the new wall plate, if there is one. You may need to drill new holes for the new model. Use a level to mark where the holes are to be drilled. Use drywall anchors, if necessary.
  - Match each labeled wire with the same letter on the new thermostat terminal, and connect them accordingly. Connect these wires as directed by the instructions that come with your particular unit. Follow these instructions carefully. Install batteries, if needed.
  - Mount the unit to the wall plate.
  - Restore power and program the new thermostat as directed.

**References:**

- The Home Depot. Prices on Programmable Thermostats, accessed on 6 November, 2011, <http://www.homedepot.com>.
- “How to Install a Programmable Thermostat,” *Lowes*, accessed on 6 November, 2011, [http://www.lowes.com/cd\\_Install+a+Programmable+Thermostat\\_128977285](http://www.lowes.com/cd_Install+a+Programmable+Thermostat_128977285).

## 5. Solar Panels

### Benefits

- *Save Money:* home solar decrease your energy bills by up to 50%
- *In Case of Power Outage:* in case of a grid failure, you will still have some power for a certain amount of time, depending on how big your battery bank is.
- *Incentives:*
  - Xcel Solar Rewards: Xcel Energy is offering a \$2.25/watt incentive to install a solar electric system, which amounts to about 30% of the total installation cost of the system. This incentive is paid upon completion of the installation.
  - Made in Minnesota: Xcel is offering a \$2.75/watt incentive for solar modules. Along with the federal tax credit/grant, you can save around 90% of the initial cost of a solar system. This incentive is paid over the course of 5 years in equal amounts.
    - Some solar installation companies will also give homeowners a loan option for long-term payments

### Costs

- *Varied Costs:* The cost of home solar will depend on many factors, including: whether or not your home is connected to the energy grid, how much energy you consume, how much sun the location of your home receives, how many days the location of your home may go without seeing sunlight, and, which energy provider you use.
- *Average Cost* of a small/average sized grid-integrated solar system with battery backup is \$19,200 (motherearthnews.com, 2009).
- *Do-it-yourself kits* can range from 5-85 Watts at a cost of \$110-\$2,000.

### Tips

- Office of Energy Security, Minnesota Department of Commerce on installing Solar
  - [http://www.state.mn.us/mn/externalDocs/Commerce/Hiring\\_a\\_Renewable\\_Energy\\_Dealer\\_121302010223\\_How2Hire.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/Hiring_a_Renewable_Energy_Dealer_121302010223_How2Hire.pdf)
- For information on do it yourself solar kits
  - <http://www.solarhome.org/solarstarterkits.aspx>

## References

- “Incentives and Financing,” *Innovative Power Systems*, accessed on 7 November, 2011, <http://ips-solar.com/incentives-and-financing/>.
- “What’s the average cost to Install a Solar-Electric System to Power your Home?,” *motherearthnews.com*, published on May 21, 2009, <http://www.motherearthnews.com/ask-our-experts/solar-electric-system-cost-z10b0blon.aspx>.

## 6. Wind Turbines

Although there are zoning restrictions against having a residential wind turbine in the city of Richfield, here is some information on them in the event that the zoning laws change.

### Benefits:

- *Save Money:* According to the USDOE, home wind turbines can lower your energy bills by 50-90% depending on your wind resource. They are beneficial if you live in a rural or remote location and are one of the cleanest sources of energy as they are non-polluting (USDOE, 2007).

### Tips:

- *Refer To:* “Solar Electric, Solar Heating, and Small Wind Energy Contractors Serving Minnesota,” *Office of Energy Security: Minnesota Department of Commerce*, September 2011 document, [http://www.state.mn.us/mn/externalDocs/Commerce/Hiring\\_a\\_Renewable\\_Energy\\_Dealer\\_121302010223\\_How2Hire.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/Hiring_a_Renewable_Energy_Dealer_121302010223_How2Hire.pdf).
- *More Information:* US Department of Energy and NREL’s brochure on wind energy
  - <http://www.nrel.gov/docs/fy07osti/41228.pdf>

### References:

- “Small Wind Electric Systems,” *US Department of Energy*, published April, 2007, <http://www.nrel.gov/docs/fy07osti/41228.pdf>.

## 7. Appliances

Energy Star Appliances are part of a joint program of the United States Environmental Protection Agency (U.S. EPA) and the United States Department of Energy (U.S. DOE) helping to save money and protect the environment through energy efficient products and practices. Energy efficient appliances can save families, on average, a third on their energy bill with similar savings on greenhouse gas emissions while still having comfortable features and style for the home (energystar.gov).

### a. Refrigerators

#### **Benefits:**

- *Most Efficient:* Energy Star qualified refrigerators save 20-30% more energy than non-qualified refrigerators.
- *Less Energy Consumption:* Energy Star qualified refrigerators use less energy, therefore reducing the impact on the environment.
- *Save Money:* By installing an Energy Star qualified refrigerator, you can save \$165 off of electricity bills during the lifetime of the refrigerator.

#### **Cost**

- *Purchase:* Cost of an Energy Star qualified refrigerator ranges from \$629-\$2,798 (TheHomeDepot.com)<sup>7</sup>.

#### **References**

- “Refrigerators,” *Energy Star*, accessed on 8 November, 2011, [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=RF](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=RF).
- *The Home Depot*, Prices on Refrigerators, accessed on 8 November 2011, <http://www.homedepot.com>.

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<sup>7</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## b. Dishwashers

### **Benefits:**

- *Most Efficient:* Energy Star qualified dishwashers are 41% more efficient than the 2007 federal standard.
- *Conserve:* By using an energy star qualified dishwasher, you save water, money on your electric bill, and reduce greenhouse gasses.
- *Save Money:* Replacing a dishwasher made before 1994 with an Energy Star appliance will save the homeowner \$30/year on their electric bill, and over the life of the product, the average homeowner will save \$120.

### **Costs:**

- *Purchase:* Cost for an Energy Star dishwasher ranges from \$249-\$809 (TheHomeDepot.com)<sup>8</sup>

### **References:**

- “Dishwashers,” *Energy Star*, accessed on 8 November, 2011, [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=DW](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=DW).
- *The Home Depot*, Prices on Dishwashers, accessed on 8 November, 2011, <http://www.homedepot.com>.

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<sup>8</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

### c. Washing Machines

#### **Benefits:**

- *Efficient:* An Energy Star washing machine can be paid for in the energy and water savings over the course of its life.
- *Save Money:* If you are replacing a washing machine that is over 10 years old with an Energy star washer, you could save up to \$135 each year on energy bills.

#### **Cost:**

- *Purchase:* Cost for an Energy Star washing machine ranges from \$269-\$899 (TheHomeDepot.com).<sup>9</sup>

#### **References:**

- “Clothes Washers,” *Energy Star*, accessed on 8 November, 2011, [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=CW](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CW).
- *The Home Depot*, Prices for Washing Machines, accessed on 8 November, 2011, <http://www.homedepot.com>.

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<sup>9</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 8. Geothermal Heat Pumps

Geothermal energy moves heat from the Earth into your house in the winter, and in the summer it moves heat from your home and discharges it into the ground. The heat from geothermal is at a constant 50 degrees year round, and in Minnesota is typically 6 feet below ground below the frost level. There are two kinds of geexchange systems; closed and open loop. Closed loop circulates water through a continuous loop of sealed pipes vertically or horizontally under your home.

### Benefits:

- *Efficient:* geothermal heat pump systems use up to 25-50% less energy than conventional heating and cooling systems
- *Save Money:* A geothermal system can cut residential energy costs by up to 30% over natural gas systems and up to 50% over electric resistance heating.
- *Possible tax breaks:* Some states offer tax incentives for geothermal systems. Check with your local provider

### Costs:

- *Variable Costs:* Installation costs vary by provider, location of your home, and what kind of system you choose to install. Check with your local provider to get an estimate.

### Tips:

- *For more information:* A brochure about geothermal energy for Minnesota homes:
  - <http://www.geocomfortmn.com/downloads/geoexchange-brochure.pdf>

### References:

- “Geothermal Technologies,” *National Renewable Energy Lab*, published 16 August, 2011, <http://www.nrel.gov/geothermal/>.
- “Geothermal Energy Basics,” *National Renewable Energy Lab*, accessed on 7 November, 2011, [http://www.nrel.gov/learning/re\\_geothermal.html](http://www.nrel.gov/learning/re_geothermal.html).
- “Minnesota Geothermal Solutions,” accessed on 7 November, 2011, <http://www.geocomfortmn.com/>.
- “Geexchange,” *Geoexahange.org*, accessed on 7 November, 2011, <http://www.geocomfortmn.com/downloads/geoexchange-brochure.pdf>.

- “Minnesota Geothermal Heat Pump Association,” accessed on 7 November 2011, <http://minnesotageothermalheatpumpassociation.com/>.
- “Geothermal or Ground Source Heat Pumps” consumer energy center.org. Accessed on 27 November 2011. [http://www.consumerenergycenter.org/home/heating\\_cooling/geothermal.htm](http://www.consumerenergycenter.org/home/heating_cooling/geothermal.htm)

## 9. Furnace

Furnaces are typically the most common source of heating for residential homes. Homeowners can make minor changes to their existing furnace to increase energy efficiency, or can replace the furnace with a new one.

### a. Furnace replacement

#### Benefits:

- *Save Money:* Replacement will reduce overall utility bills by increasing efficiency of the unit
- *Most Efficient:* Efficiency of an old furnace: 50%-70%; Efficiency of new furnace: 70%-85%

#### Cost:

- *Cost Comparison:*
  - Average cost to run a 15-20 year old system: \$1000/year
  - Average cost to run a new, high efficiency system: \$594/year
  - Average cost of a new furnace is \$1,200 (Home Depot)<sup>10</sup>

#### Tips:

- *Time to Replace:* If your furnace is 15-20 years old, it is time to replace it.
- *For more Information:* [www.StandardHeating.com](http://www.StandardHeating.com) is a Minnesota based company that specializes in heating and cooling systems

### b. Furnace tune-up

#### Benefits:

- Improve system performance
- More energy-efficient operating system for reduced utility bills
- Lengthens the life of the furnace
- Prevents expensive future repairs
- Replacing and/or cleaning furnace filters will improve efficiency

#### Cost:

- Can be done for free if you do it yourself. Step by step instructions available at [www.DIYNetwork.com](http://www.DIYNetwork.com).

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<sup>10</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

- Professional tune-up:
  - Oil-burning forced air furnace: \$75-\$125
  - Gas furnace: \$80-\$130

**Tips:**

- *Shop around* for professional tune-ups. Often there are deals offered by each company.

**Resources:**

- *The Home Depot*, [www.homedepot.com](http://www.homedepot.com)
- *Bonfe*, Plumping, Heating, Air Conditioning, Electrical & Appliance Repair, [www.bonfe.com](http://www.bonfe.com)

## 10. Alternative Heating

Alternative heating sources, such as pellet stoves, can help reduce utility bills, release cleaner air and reduce the household's carbon footprint.

### a. Pellet stove

- Pellet stoves have become an increasingly popular energy source for sustainability-conscious homeowners. The “pellets” used in these stoves are typically recycled materials or items that are produced with little energy consumption.

#### **Benefits:**

- *Burns cleaner* than log-burning stoves
- *Inexpensive* to operate
- *Variety fuel source:* Burns nut shells, corn pellets, wood pellets; all pre-packaged
- *Availability of fuel source(s):* There are various places that sell corn and wood pellets such as Wal-Mart, hardware stores, other department stores, and various online sources.
- *Competitive Purchase Cost:* Similar in cost to a new furnace
- *Efficient:* 60%-75% efficient

#### **Cost:**

- *Purchase:* New pellet stove costs \$1,500+
- *Fuel Costs:*
  - Wood pellets: 40 lb. bag costs an average of \$6.00
  - Corn pellets: 40 lb. bag costs an average of \$5.60

#### **Tips:**

- Corn and wood pellets are most commonly used in pellet stoves, so they are typically easy to find. Nut shells are more difficult to find, and are often used only when the consumer obtains nutshells from their own nut usage.

**Resources:**

- The Home Depot<sup>11</sup> provides a Pellet Stove Buying Guide, which can be found at the following website address.
  - [http://www.homedepot.com/webapp/wcs/stores/servlet/ContentView?pn=KH\\_BG\\_HF\\_Wood\\_Pellet\\_Stoves&langId=-1&storeId=10051&catalogId=10053&locStoreNum=159](http://www.homedepot.com/webapp/wcs/stores/servlet/ContentView?pn=KH_BG_HF_Wood_Pellet_Stoves&langId=-1&storeId=10051&catalogId=10053&locStoreNum=159)
- *Haley Comfort Systems*, A Minnesota-based company, [www.haleycomfort.com](http://www.haleycomfort.com)

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<sup>11</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 11. Insulation, Sealing Ducts & Leaks

Proper insulation and duct and leak sealing reduces utility bills, as less heat will escape the household. With less heat escaping the home, the unit will stay warmer longer and will become warmer in a shorter amount of time.

- **Caulking, Weather Stripping & Spray Foam**

Many older homes have holes and small gaps around the outside walls, roof, and foundation. Some holes/gaps are larger than others such as broken or missing windowpanes, or basement doors that do not close properly. These small gaps can contribute to large amounts of air that move through our homes. On cold days, this means that heat is escaping while cold air is entering. In the summer, cool air-conditioned air is released from the gaps, or hot air may be forced in on windier days. Air movement has many negative effects; it increases heating and cooling costs and increases dust levels. You can hire a professional energy auditor to find the leaks in your home.

**Benefits:**

- *Save Money:* Sealing leaks will reduce energy bills Savings ranging from 5%-10%, in an already well-sealed home or 30%-40% and more depending on the condition of the house
- *Various Uses:* Can be used in attics, basements, crawlspaces, doors and windows

**Costs:**

- *Cost varies* depending on the size, age and condition of your home and whether you do it by yourself or choose to hire a professional.
- *Cost Estimate* for installation of caulking and weather-stripping for 2,500 square foot home including all windows, doors and vertical trim boards.
  - Materials only: \$150
  - Contractor's total including materials, labor and markup: \$750

**b. Insulation-Spray foam, cellulose, rigid foam board, fiberglass**

**Benefits:**

- *Easiest and most cost-effective* to add to the attic
- *Reduce energy bills* by using the furnace and/or air conditioning less frequently, as hot and cold air will remain in their desired places for longer time periods

**Cost:**

- *Purchase:* Costs between \$10-\$500, depending on the area size

**Tips:**

- 12-15 inches of insulation recommended for best results

**Resources:**

- U.S. Department of Energy: Energy Efficiency & Renewable Energy, “Energy Savers: Insulation and Air Sealing”
  - [http://www.energysavers.gov/your\\_home/insulation\\_airsealing/index.cfm/mytopic=11220](http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11220)
- *RetroFoam Of Minnesota, LLC*, insulation products and resources, [www.retrofoammn.com](http://www.retrofoammn.com)
  - 1170 Red Fox Rd, Arden Hills, MN 55112
  - Phone: (866) 670-FOAM
- *The Home Depot*<sup>12</sup>, [www.homedepot.com](http://www.homedepot.com)

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<sup>12</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

### c. Duct Sealing

#### **Benefits:**

- *Reduces heat loss* by 20%
- *Easy Repair:* Exposed ducts in attics, basements, crawlspaces and garages can be repaired with duct sealant
- *Save Money:* Will reduce energy bills significantly
- *Reduces indoor air pollution*

#### **Cost:**

- *Purchase:* Between \$5-\$40

#### **Tips:**

- Sealing ducts in your home will allow for proper insulation of home heating systems. This means, the size of the system could be reduced when a home is properly sealed. A smaller system uses less energy.

#### **Resources:**

- U.S. Environmental Protection Agency & U.S. Dept. of Energy's ENERGY STAR website, "Home Improvement: Duct Sealing":
  - [http://www.energystar.gov/index.cfm?c=home\\_improvement.hm\\_improvement\\_ducts](http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts)
- Energy Trust of Oregon
  - <http://energytrust.org/residential/incentives/Weatherization/DuctSealing>
- *The Home Depot*<sup>13</sup>, [www.homedepot.com](http://www.homedepot.com)

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<sup>13</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 12. Compact Fluorescent Light Bulbs

Compact fluorescent light bulbs (CFLs) are a newer, more energy efficient form of lighting for your home. CFLs can be screwed into any normal light socket in your home.

### Benefits:

- *Long Lifespan:* Compact fluorescent light bulbs (CFL's) cost more initially, but last 10 times longer than an incandescent light bulb
  - A 100W incandescent must be replaced 10 times in 4.5 years, whereas a 25W CFL does not need to be replaced in that same time period.
- *Lower Energy Requirement:* The wattage used in CFL's is far less than an incandescent (25W vs. 100W)
  - One CFL uses about 75% less energy than an incandescent
- *Less excess heat produced:* CFL's produce 90% less heat, while producing more light per watt

### Cost:

- *Purchase:* One 25W CFL costs approximately \$3.40
  - Average annual energy cost of one CFL: \$6.00, whereas one incandescent can cost up to \$25 annually in energy production

### Tips:

- It is best to buy CFL's in multi-packs, which will bring down the cost of each individual light bulb overall.
- Compare prices between stores, as they may vary, look and wait for sales
- For softer illumination, choose a 3500K-4100K light bulb. For more intense light, choose 5000K-6500K light bulbs.

### Resources:

- U.S. Environmental Protection Agency & U.S. Dept. of Energy's ENERGY STAR website, "Products: Light Bulbs":
  - [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.s howProductGroup&pgw\\_code=LB](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.s howProductGroup&pgw_code=LB)
- *The Home Depot*<sup>14</sup>, [www.homedepot.com](http://www.homedepot.com)

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<sup>14</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 13. Doors & Windows

Heat and cold air loss in older homes can often be contributed to outdated, inefficient windows and doors. There have been a variety of technological advances that have made window and door replacement a popular choice for homeowners trying to lower utility bills or become more conscious of sustainability.

### a. Garage Doors

#### **Benefits:**

- *Reduce energy loss:* Garages are a big source of energy loss, which will be reduced
- *Additional sealing:* Weather stripping the garage door will reduce leaks

#### **Costs:**

- *Purchase:* Garage door insulation kits cost between \$50-\$100
- *Extra Costs:* Insulated garage door costs between \$200-&700

#### **Tips:**

- Replacing your garage door with an insulated version will reduce heat loss. This is a fairly easy do it yourself project that doesn't take much time or money.

#### **Resources:**

- *Great Lakes Door LLC*, A Minnesota-based company:
  - <http://www.greatlakesdoor.net/products.php>
- *Eco-Green Garage Doors*, <http://www.ecogreengaragedoors.com/>
- *The Home Depot*<sup>15</sup>, [www.homedepot.com](http://www.homedepot.com)

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<sup>15</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## **b. Front/Side/Back Doors**

### **Benefits:**

- *Save Energy/Heat:* Replacing doors or adding weather stripping will reduce heat loss

### **Cost:**

- *Purchase:* Cost of new front/back/side doors begins at \$130

### **Tips:**

- Before replacing a door, see if there is a reduction in heat loss with simply plugging leaking areas with weather stripping.

### **Resources:**

- *The Home Depot*<sup>16</sup>, [www.homedepot.com](http://www.homedepot.com)

## **c. Windows**

### **Benefits:**

- *Tax credit* of 10% of total window cost up to \$200 (Expires 12/31/11)
- *Reduce energy loss* by replacing windows through tighter seals, keeping your house warmer while decreasing utility bills and needed furnace time
- *Quick payback on investment:* Energy Star windows will pay for themselves in four years with reduced energy bills

### **Cost:**

- *Variety in Prices:* New EnergyStar windows range in price starting at \$150

### **Tips:**

- Blackout curtains are also an option, and reduce heat loss by 25%
- Double or triple pane windows reduce energy loss the most. EnergyStar windows are shown to pay for themselves in four years with reduced energy bills occurring immediately. If you're not ready for total window replacement, temporary fixes such as weather stripping and installing plastic over windows in winter will help reduce heat loss. Blackout curtains are also an option, and have proven to reduce heat loss by 25%.

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<sup>16</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

**Resources:**

- U.S. Environmental Protection Agency & U.S. Dept. of Energy’s ENERGY STAR website, “Products: Residential Windows, Doors and Skylights”:
  - [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=WI](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=WI)
  
- *The Home Depot*<sup>17</sup>, [www.homedepot.com](http://www.homedepot.com)

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<sup>17</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## 14. Outlets & Fireplaces

### a. Outlet Insulation & Cover

#### **Benefits:**

- *Reduce Drafts:* Air escapes through electrical outlets; foam insulating gaskets and covers will reduce this air loss

#### **Costs:**

- *Purchase:* Gaskets and covers cost \$3-\$10

#### **Resources:**

- *Conservation Mart*, “Electrical Outlet Sealing”:
  - <http://www.conservationmart.com/c-97-electrical-outlet-sealing.aspx>
- *The Home Depot*<sup>18</sup>, [www.homedepot.com](http://www.homedepot.com)

### b. Fireplaces

Fireplaces are often used as a heating source in residential homes. Typically, fireplaces are used specifically to heat the room they are located in. Older fireplaces can be a major contributor to heat loss in your home, as it is easy for the warm air to escape, or for colder air to enter the home while not in use.

#### **Benefits:**

- *Save Your Heat & Money:* Upgrading the flue damper can reduce heat loss by 90%
  - Glass doors on the fireplace can also reduce heat loss

#### **Costs:**

- *Purchase Costs:*
  - Cost of a new flue damper: \$8+
  - Cost of glass door: \$150-\$500

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<sup>18</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

**Tips:**

- Sealing your fireplace:
  - Large amounts of heat can be lost through your fireplace. If your flue does not close all the way, huge amounts of war air will escape in the winter. Consider installing a “chimney pillow,” or “chimney balloon.” This device inflates and seals off the chimney.

**Resources:**

- *FireplaceGuys.com*<sup>19</sup>, “Fireplace sales and services”:
  - <http://www.fireplaceguys.com/>
- *Woodland Direct: Your Fireplace, Chimney & Outdoor Connection*, A Minnesota-based company:
  - <http://www.woodlanddirect.com/>
- *The Home Depot*, [www.homedepot.com](http://www.homedepot.com)

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<sup>19</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## II. Water Conservation

This section offers many projects that will reduce water use in your home. There are many benefits to reducing water use that go far beyond the reduction of your water bill. Water is an extremely valuable and scarce resource. By reducing your water consumption through increased water efficiency, you are reducing strain on natural resources and enabling them to be used in a more sustainable manner.

### In this section:

1. Flushing Your Water Heater To Remove Sediment
2. Water Heater Blanket & Pipe Insulation
3. Adjusting Water Heater Temperature
4. Faucet-Efficient Shower Heads
5. Water Efficient Toilets

### Water Conservation Resources Utilized:

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 1. Flushing Your Water Heater To Remove Sediment:

Annually, thousands of gallons of cold water enter water heater and bring along sand, rust and dissolved minerals that settle at the bottom. Over time, the substances at the bottom harden as a result of temperature fluctuations (heating/cooling). The sediment on the bottom eventually thickens thus reducing the transfer of heat to the water. This occurs in electric water heaters as well. In gas-fired water heaters sediment on the bottom traps the hot water. As the temperature increases, hot water is released from the sediment. This will result in a loud popping noise. If you hear these noises, it is a sign that you should flush the tank. Even if you do not hear these noises, it is a good idea to flush the tank if it has not been flushed for more than a couple of years.

### Benefits:

- *Save Energy & Money:* Sediment on the bottom of your tank increases energy necessary to heat the water by almost 70%, which is significant because water heating accounts for about 17% of home's annual energy bill.
- *Choice:* Less expensive water heaters are more costly to operate. Gas water heaters last about 12 years, when regularly maintained. Electric models can last up to double that, but they are less economical to operate.

### Costs:

- *Cost to flush:* Nothing (possibly cost of vinegar), to \$100 if you hire a plumber. Usually easy to do-it yourself if you follow manufacturer's instructions
- *New Water Heater Purchase:* Replacement for water heater: \$200-\$1000 (depends on size) plus installation. Check Energy Guide label when purchasing new storage water heater to compare FHR (first hour rating, or capacity), EF (energy factor) and expected lifespan.

### Tips

- *Vinegar:* If it has been a few years since the installation of your tank, you might find it helpful to rinse it out with white vinegar prior to refilling. The acetic acid in vinegar dissolves calcium deposits left in water heaters. For optimal results, let the vinegar sit for about one to two hours.
- *For more information:* See How to Drain a Water Heater:
  - <http://www.diynetwork.com/how-to/how-to-drain-a-water-heater/index.html>

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 2. Water Heater Blanket & Pipe Insulation:

This project improves your hot-water supply, reduces fuel use and greenhouse gas emissions. It is advised to choose a blanket with an insulating value of at least R-8. (R describes a measure of resistance to heat movement. A higher R-value is better.) In older homes, insulation blankets provide many benefits to tanks that are not well insulated. If your water heater's storage tank has a high R-value of insulation (at least R-24), this project would not be necessary.

### Benefits

- *Reduce heat loss:* U.S. Department of Energy (DOE): “unless your water heater's storage tank already has a high R-value of insulation (at least R-24), adding insulation to it can reduce standby heat losses by 25% to 45%.
- *Save Money:* This will save you about 4% to 9% in water heating costs. DOE also reports insulating hot-water pipes reduces heat loss and can increase water temperature and will raise the water temperature 2°F–4°F.
- *Reduce costs:* This will allow you to adjust your water temperature to a lower setting, thus reducing energy costs.
- *Conserve water:* You will also be using less water because you will not have to run the shower as long to wait for warm water.

### Costs

- *Purchases:*
  - Insulation blanket: \$16-22
  - Pipe insulation pieces: \$4-5 for 6' length
  -
- *Installation:* These can be installed by utility companies at low or no cost to qualified homeowners.
- *Time:* As long as you can access the pipes, this is a simple project that does not require hiring a plumber.

### Tips

- See How to Insulate Your Water Heater:
  - [http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=13070](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13070)
- See How to Insulate Your Pipes:
  - [http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=13060](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13060)

**Recourses:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

### 3. Adjusting Water Heater Temperature

According to the U.S. Department of Energy, heating water for showers/baths, washing dishes and clothes adds up to about 17% of a family's annual energy demand. One way to reduce energy consumption resulting from these activities is simply to lower the temperature setting on your water heater. Most water heaters are set too high, so a small adjustment is not likely to be noticed by anyone in the home. Remember, when you combine this with other projects the savings will eventually add up to an even larger sum.

#### Benefits

- *Save Money:* The U.S. Department of Energy states that for every 10 degrees F you reduce your water temperature you can save between 3% and 5% in energy costs.

#### Costs

- *Time:* Luckily there are no costs for this project, except your time

#### Tips

- You can save more money by lowering the temperature even more, or turning off your water heater completely if you are going out of town or leaving for an extended vacation.
- When measuring water temperature use the cup method as described above. If you hold the thermometer under a stream of water you may have a lower temperature reading due to aeration.
- When you are adjusting the temperature controls on an *electric water heater* double check that the top and bottom elements are set for the same temperature. If they are set at different temperatures, one heating element may be doing more work than the other leading to more wear and tear.
- As a general safety precaution: ALWAYS turn off the electricity before adjusting any settings.
- See How to Adjust your Water Heater Temperature for gas/electric water heaters:
  - [http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=13090](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13090)

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 4. Water Heater Anode Rod Replacement

Unfortunately, storage water heaters compared to other appliances have a rather short lifespan. There are some precautions conscious homeowners can take to increase a water heater's useful life. What are anode rods? They are three- to four-foot long metal rods made from magnesium or aluminum and are suspended from the top of the tank.

### Benefits:

- *Self-Replacement:* If you replace the rod by yourself your saving will be even more substantial, however you will still save on the longevity of buying a new water heater regardless.
- *Increase lifespan:* Anode rods are found in all electric and gas water heaters. Replacing an anode rod will not reduce energy use; however, it will increase the lifespan of your water heater (in some cases doubling the lifespan).
- *Save money:* As a homeowner, this can result in big savings of at least \$900 (cost of water heater replacements plus installation).
- *Green your life:* In the larger scheme of things, this project helps your family reduce their "carbon footprint" by reducing the amount of materials consumed.
- *Save landfill space:* Extending the life of your water heaters means that there are less products being added to already full landfills.

### Costs:

- *Purchasing:* Anode rods cost between \$20-50 and can be up to \$150 for a flexible one. If you hire a professional to install the anode rod you should expect to pay an additional \$150.

### Tips:

- Anode rods should be inspected every three years. If you know your home has a water softener, check the anode rod every year and replace when necessary.
- See How to Change a Water Heater Anode Rod video:
  - <http://www.thisoldhouse.com/toh/video/0,,20047047,00.html>

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 5. Tankless Water Heater (TWH)

If your storage water heater is nearing the end of its life (meaning it is older than ten years and has not been properly maintained), you might consider a TWH.

Similar to conventional water heaters, TWH perform the same tasks without the standby losses of storage tank heaters. How? TWH do not suffer standby losses because they do not have to store hot water. When hot water is needed, they have the ability to generate it. When a hot water faucet is turned on, cold water flows into the water heater. This initiates a flow sensor inside the TWH, which detects water flow and sends a signal to a tiny computer inside the unit. Then, a signal is sent to the gas burner or electric heating element in the water heater, which turns on the heat source. These processes result in an increase in the water flowing through the TWH of around 50 degrees F to 120 degrees F in just a few seconds.

### Benefits:

- *Save money:* Reduction of annual energy bills of about 20%.
- *Possible rebates:* There might be rebates offered by local utilities and/or tax incentives from federal or state governments. Check out [www.dsireusa.org](http://www.dsireusa.org), the Database Incentives for Renewables and Efficiency for various financial incentives in your state.
- *Continuous flow* of hot water
- *Space saving*, especially models designed for outdoor installation
- *Life expectancy* of 20 years
- *Better equipment:* Less chance of tank leaks and water damage compared to conventional water heaters

### Costs:

- *Purchasing:* A TWH costs around \$600-\$1500 depending size and output.
- *Installation:* To install a TWH, expect to pay anywhere from a few hundred dollars to \$1,000 for more difficult projects.

### Tips:

- See recommendations for purchasing TWH:
  - [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=WH](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=WH)
- TWH need special venting, be sure that your house is suitable

**Recourses:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 6. Solar Hot-Water Systems

It is generally a good idea to first improve the efficiency of your home on a smaller scale, for example, by installing water-efficient showerheads, before worrying about solar hot-water systems. If you want to make an even greater reduction of your carbon footprint and cut your fuel bill, it might be wise to consider a solar hot-water system.

For those unfamiliar with hot-water systems, the simplest solar hot-water system is the *bath solar water heater*. This technology is better suited for warmer sunny climates. Batch water heaters have a black water tank inside an insulated collector box, or a well-insulated solar panel, which holds a large black copper pipe filled with water. These units are either mounted on the roof or on the ground in a sunny area. Most other solar systems contain pumps, but the batch water heaters do not require pumps or electronic controls. When a hot water faucet, shower, or dishwasher is used, this initiates the solar-heated water to release from the tank. What about cooler climates where freezes occur? In these types of climates, a more costly pump-driven solar hot-water system is recommended.

### **Benefits:**

- *Long-lived investment:* Although this is a large investment, the systems can last for 40 years if properly installed and maintained.
- *Efficient:* These systems are designed to supply approximately 70% of a household's hot-water requirement, although this will range depending on the season.
- *Save money:* By installing a solar hot water heater, your water heating bills should drop 50%–80%, on average.

### **Costs:**

- *Purchasing:* \$2,000-\$7,000 depending on the type of system, complexity etc.

### **Tips**

- Install a solar hot-water heater in a sunny location, usually on a south-facing roof with a good amount of solar exposure from 9 a.m. to 3 p.m. during the entire year.
- Be sure to shop around multiple local installers instead of settling on the first one you come across.

- The cost of a hot-water system depends on the type of system and difficulty of installation. Each of these factors are dependent on the type and slope of the roof and amount of work necessary to run pipes.
- When hiring an installer, it is best to find one that has been in the business for 5 to 10 years and has had a great deal of experience in installing these systems.
- Installers can be found at **www.findsolar.com**. It is a good idea to see if the installers you have in mind are certified by the North American Board of Certified Energy Practitioners (NABCEP). Be sure to ask if they have received training provided by solar system manufacturers along with the number of installations completed.
- Certified installers in your region can be found on the NABCEP website, [www.nabcep.org](http://www.nabcep.org)
- You can compare the performance of solar collectors on the website of Solar Rating and Certification Corporation, [www.solar-rating.org](http://www.solar-rating.org)
- Make sure to check out the latest state and federal incentives to install a solar hot-water heater at [www.dsireusa.org](http://www.dsireusa.org)
- Check out incentives for purchasing energy-efficient products on [www.energy.gov/taxbreaks.htm](http://www.energy.gov/taxbreaks.htm)
- Tips for Solar Water Heaters in Minnesota:  
[http://www.state.mn.us/mn/externalDocs/Commerce/Hiring\\_a\\_Renewable\\_Energy\\_Dealer\\_121302010223\\_How2Hire.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/Hiring_a_Renewable_Energy_Dealer_121302010223_How2Hire.pdf)
- For more information and “How-To-Tips” see:  
[http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=12850](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12850)

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 5. Faucet Aerators

This project is especially appealing for those looking into a quick, easy and inexpensive way to reduce utility bills. A faucet aerator is a small screen-type device that reduces water flow by adding air into the water. It can be purchased at hardware or home improvement stores.

### Benefits:

- *Conserve water:*
  - A kitchen aerator can save about 3 gallons of water per day in a typical household.
  - Bathroom aerators can save 2.3 gallons of water each day.
- *Save:* Think about this over a larger time span. One kitchen and two sink aerators will save about 2,900 gallons.

### Costs:

- *Purchase:* Prices range from \$2-\$10.
- *Replace the old:* If your faucet is old you might want to consider replacing the entire unit. This will cost around \$200 for the contractor's total, including materials, labor and markup.

### Tips:

- *How To Install Low-Flow Fixtures:*  
[http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=13050](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13050)

### Recourses:

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 6. Water-Efficient Shower Heads

This is by far one of the quickest, easiest and cheapest things you can do that will cut down on your utility bill while saving energy and water. Also, this project will produce some of the greatest returns with inputting the least amount of effort. Showering constitutes for around 17% to 25% of residential indoor water use. Water-efficient showerheads range from 1.5 to 2.5 gallons per minute compared to older models that can use 5 gallons of water per minute or more!

### Benefits:

- *Conserve water:* Reduce hot-water consumption by 30% or more.
- *Inexpensive showerheads* could pay themselves many times over in one year.
- *Reduce* the need for energy that is required to heat water for showers, thus lessening global air pollution impacts

### Costs:

- *Purchase:* Low-flow showerheads cost between \$10-\$50. More expensive models can cost \$60-\$80.
- *Do-it-yourself or hire:* Most homeowners can replace a showerhead themselves. If you hire a professional a service charge will cost \$100 or more. Note: having a plumber do several small projects at once will save you money overall.

### Tips:

- Use a natural fabric such as cotton or bamboo for your shower curtain. Plastic (PVC) curtains and liners contain a chemical DEHP that may be carcinogenic. Check plastics for the recycle symbol #3 or the letter V; either symbol indicate PVC. If you wish to use plastic, a safer, biodegradable alternative is PEVA (non-chlorinated vinyl).
- “WaterSense” labels indicate the EPA’s designation to “help consumers find quality showerheads that save water without sacrificing performance.” You may also read the package label for gallons per minute information.
- Check online reviews prior to making your purchase. If you are dissatisfied with your purchase, many places allow you to return the showerhead.
- See How To Install Low-Flow Fixtures:
  - [http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=13050](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13050)

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

## 7. Water-Efficient Toilets

Old water-intensive toilets consume as much as 3.5 to 7 gallons of water per flush! Installing a water-efficient toilet will save you money on your water bills.

If your residential home uses well water, a more efficient toilet will reduce the run time of your well pump, which in turn reduces energy consumption. Water-efficient toilets fit into three categories: single-flush, dual-flush and flushmate-equipped toilets.

### Benefits: Savings from Water-Efficient Toilets

Toilet Types	Daily Water Use*	Annual Water Use*
Conventional 3.5 gpf	17.5	6,387
Single-flush 1.6 gpf	8	2,920
Dual-flush Average 1 gpf	4.8	1,752
Pressure-Assisted 1 or 1.6 gpf	4.8 to 8	1,752 to 2,920

Table from: Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).

\*gallons per person

### Benefits:

- The EPA's WaterSense website states, "Consider installing a WaterSense labeled toilet, which uses 20 percent less water while offering equal or superior performance. Compared to older, inefficient models, WaterSense labeled toilets could save a family of four more than \$90 annually on its water utility bill, and \$2,000 over the lifetime of the toilets."

### Costs:

- The range in price for a water-efficient toilet is about \$50 to \$200. Most of the toilets are in the \$100-\$200 range. Having a contractor put in the toilet will cost around \$400-\$500.

### Tips:

- Check out [www.terrylove.com](http://www.terrylove.com), a website that includes information on water-efficient toilets from contractors' and homeowners' ratings. Over the long run, it is more cost effective to pay more money for a higher quality more efficient toilet

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- U.S. Department of Energy, *Energy Savers*, (February 9, 2011), accessed 15 November, 2011, <http://www.energysavers.gov/>.
- Environmental Protection Agency (EPA). *WaterSense*. (November 17, 2011), accessed November 15, 2011. <http://www.epa.gov/watersense/>.

### III. SUSTAINABLE BUILDING SUPPLIES & PRODUCTS

Sustainable building supplies and products encompass a wide range of opportunities that create a safer environment within ones home and also reduce waste, reuse materials, and encourage recycling. There are many choices to be made when renovating a home, by making conscientious decisions along the way, and referring to reliable resources, such as those given within this guide, one move the household and neighborhood toward sustainability.

A tip is to focus on the “three R’s”: **reduce, reuse, and recycle**. By choosing products and supplies that are gently used, made of recycled content, manufactured locally, and are of high-quality, etc., these decisions ultimately reduce waste, decrease carbon footprints, and conserve raw materials for future generations to use. There are numerous sources for “gently used” building materials and/or surplus supplies from manufacturers. Businesses that supply these types of products include the ReUse Center<sup>20</sup> and Habitat for Humanity ReStore<sup>21</sup>, both have many locations within the twin cities. Supporting locally manufactured products, purchasing durable and high quality materials that have a longer lifespan, and hiring contractors that are familiar with green building techniques are also steps towards making a sustainable home.

NOTE: Try to paint and do flooring renovations at times of the year when windows can be opened for extra ventilation. It is also suggested to purchase new furniture when the weather is adequate enough to leave windows open for that extra ventilation in the case that the furniture, paints, flooring, adhesives, etc. may be a short-term source of indoor air pollution.

#### **This Section Includes:**

1. Green Flooring: basic tips, considerations, & resources
  - a. Wood: reclaimed/salvaged wood
  - b. Non-wood: bamboo, cork, natural linoleum, and ceramic tile
  - c. Carpeting
2. Cabinetry
3. Green & Safe: Paints, Stains and Finishes

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<sup>20</sup> The ReUse Center: please see pages 7-8, “Green Disposal & Materials Recycling” section for more information.

<sup>21</sup> Habitat for Humanity ReStore: please see pages 7-8, “Green Disposal & Materials Recycling” section for more information.

## 1. Green Flooring

Flooring options for the home are nearly endless and green flooring options are plentiful and just as interesting as conventional applications. Some basic guidelines for choosing sustainable, environmental responsible and healthy options for flooring are discussed in this section.

### Important Considerations When Considering Green Flooring Options for Your Home:

1. Is a brand new floor necessary?
  - The current flooring may require refinishing, polishing, or other touch-ups instead of removing and reinstalling new.
  - Assess the current existing flooring for durability and hazardous material such as lead and asbestos
2. Selecting wood materials:
  - Purchase FSC (Forest Stewardship Council) certified products
  - Purchase non-formaldehyde containing pressed-wood products
  - Reclaimed wood is a green option, that conserves raw wood resources, reduces waste and reuses salvageable building materials
  - Be sure to check for residual lead paint and verifying the durability and structural integrity of used wood.
3. Flooring from more rapidly growing resources:
  - Durable options other than wood, includes bamboo, cork, and natural linoleum
    - Pay attention to the source of the material, ask questions, find the answers
      - How far the flooring resource originated from; did it travel overseas from another country?
      - Is the material using non-hazardous products in manufacturing procedures
    - Most of these flooring options require adhesives for installation, it is very important to choose non- to low VOC content adhesives
4. Carpeting and rugs:
  - Select natural materials: wool, jute, hemp, cotton
    - Avoid carpeting/rug material(s) that are treated with chemicals

## 5. Durability and Longevity

- Consider the long-term impacts of requirements for cleaning and maintenance of your flooring choice

### Reusing Salvaged & Surplus Materials

- A large variety of products are readily available and can be located, including:
  - Floor tile, granite, marble, brick, timber, windows, doors and door frames, bathroom (toilet and sinks) fixtures, cabinets, and hardware
- Resources: Minnesota Materials Exchange, Habitat for Humanity Restore, ReUse centers, MPCA: MN Recycled Products Directory,

### IMPORTANT NOTE: Green Flooring Options Cost:Benefit

These flooring options all require a sub-floor and presume that in the case of complete renovation, no to low VOC/formaldehyde pressed-wood materials are chosen. Also, the adhesives, sealants, finishes and cleaners used are to be no to low VOC content (see paint, stains, and finishes subsection). Be sure to match your specific flooring type to the proper adhesive type.

### **Resources:**

- ReGreen, <http://www.regreenprogram.org/>.
  - result of collaboration between the American Society of Interior Designers (ASID) Foundation and the U.S. Green Building Council (USGBC)
    - provides various reliable resources and tools for green home implementations
- Minnesota Sustainable Housing Initiative
  - “Green Communities with Minnesota Overlay for Single Family”, <http://www.mnshi.umn.edu/kb/guidelines/gcs/gc.html>.
- University of Minnesota: Minnesota Green Affordable Housing Guide
  - [http://www.greenhousing.umn.edu/comp\\_flooring.html](http://www.greenhousing.umn.edu/comp_flooring.html).
- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).

## a. Wood: Reclaimed or Salvaged Wood

### **Benefits:**

- *Reusing* or reclaiming wood is sustainable and conservative
- *Long life*: Can carry a very long lifespan with proper cleaning and maintenance
- *Renewable resource*; select from FSC certified products, reclaimed wood, or reuse wood material via a ReStore
- *Opportunities*: Shopping around will provide more opportunities to locate unique and durable wood
  - Might even find wood materials that are now not available/harvested such as chestnut wood
- *Readily Available*: There are many local suppliers
- *Environmental benefits* include:
  - The wood going to a landfill or being ‘wasted’ is instead reused or reclaimed
  - You conserve trees and forests for future use
  - Get a sense of awareness and acknowledgement for the importance of the natural environment
  - often times the final product is more attractive, and of higher-quality than that of newly bought wood flooring

### **Costs:**

- *Limited Supplies*: Supplied quantities may not be in abundance; if flooring is needed for a very large area, it may be difficult to find enough of the same materials for the whole project
- *More Expensive*: Generally slightly more expensive than non-wood flooring options
  - Please refer to table on page 64
- *More Cost(s)*: Reclaimed wood can cost more than new wood flooring
  - The wood may need to be sanded and refinished, remove nails and other work before the flooring can be installed

### **Tips:**

- Shop around, make phone calls if necessary, but always go on-site to view the material before purchasing
- Key words to use while searching for wood flooring/products:
  - Demolition materials/supplies, recovered flooring/building materials

## **b. Non-Wood: Bamboo, Cork, Natural linoleum, Recycled content tile**

### **1. Bamboo:**

#### **Benefits:**

- *Rapidly renewable resource*, in the grass family, that can be harvested every 3-10 years
  - Can be harvested once and will regrow to be harvested repeatedly
- *Comparative alternative to wood* flooring, with similar hardness and appearance
- *Different available styles*: vertical grain, flat grain, or multiple layers
- *Utility*: Great for low traffic areas

#### **Costs:**

- *Unhealthy Substances Uses In Manufacturing*: Adhesives are required in manufacturing this product as flooring; this is generally urea-formaldehyde, which does not off-gas once it is dry but is not healthy for the employees working with these materials
- *Pretreated*: Bamboo flooring may be treated with a preservative, boric acid, which is “relatively nontoxic”
- *Utility*: Not the best choice for high traffic areas due to denting and scratching
- *Travels From Afar*: Grown in Southeast Asia, China and Vietnam; shipping a considerable distance adds to the carbon footprint of the product
- *Please refer to table on page 64*

#### **Tips:**

- Shop around to consider options; prices, warranties, formaldehyde content, etc.
  - Formaldehyde free products are available

## 2. Cork:

### **Benefits:**

- *Rapidly renewable resource:* cork is the bark off the cork oak tree that can be harvest and re-harvested off of the same tree
  - First harvests are made on a tree about 20 years old
  - Regeneration time for the next harvest is 9-14 years
  - Total lifespan of tree is about 120 years
- *Durable,* minimal maintenance, and minimal off-gassing
- *Recyclable*
- *Made of Reused Materials:* Cork flooring is typically produced using waste cork from other products like corks for wine; making this flooring option a green option
- *No formaldehyde* is used, generally, in production
- *Dampens sounds,* hypo-allergenic, fire resistant
- *Utility:* Will indent, but most of the time, rebound unless constant pressure (heavy weights; furniture, etc.) is applied

### **Costs:**

- *Shipped from Afar:* Cork grows in micro-climates; specific areas it grows include North Africa and Europe, contributing to the carbon footprint of this product because of long shipment distances
- *Cork fades* in color or yellows with age, it also tends to expand and contract in areas with fluctuations in heat and moisture (like Minnesota)
- *Please refer to table on page 64*

### **Tips:**

- Best options for cork flooring are moisture-resistant
- Check for and compare warranties

### 3. Natural Linoleum:

#### **Benefits:**

- *Very green flooring option:*
  - Composed of linseed oil, cork and wood powder, organic pigments, and limestone (& possibly pine resin) mounted upon a jute backing
  - Renewable and biodegradable flooring product
- *Low flammability* and is oil and grease resistant
- *Anti-static* and has natural bacterial fighting properties
- *Hardens as it ages*
  - Resistant to scratching and cracking
- *Less complicated* flooring option to install especially compared to tile
- *Utility:* Great option for kitchen and bathroom
  - Easy to clean

#### **Costs:**

- *Shipped From Afar:* Produced in Europe, shipped over seas to the U.S.; this product has a larger carbon footprint due to energy requirements for shipping
- *Off-gassing* during and shortly after installation
- *Please refer to* the table on page 64

#### **Tips:**

- Use non-toxic/no-VOC adhesives, sealants, etc.
- When installing be sure to have ample ventilation and outdoor air flow as to reduce negative effects of off-gassing/indoor air pollution
- Be aware: vinyl is much different than linoleum
  - Vinyl is a petroleum product
  - Off-gases and contributes much more than linoleum to indoor air pollution

#### 4. Tile: Recycled Content Tile:

##### **Benefits:**

- *Very durable:* fire and scratch resistant
- *Long lifespan* with proper installation and maintenance, saving money in the long run
- *East to clean*
- *Available as recycled content ceramic tile*
  - Generally the recycled content or even recycled/reuses tile is more unique in design/color than conventional tile
  - Composed of miscellaneous recycled glass or byproducts
  - Recycling saves energy: reduces waste, conserves raw materials, prevents contribution to landfills, reduces carbon footprint(s)
- *Utility:* Many patterns, styles, and colors make for diverse application opportunities (for floors, wall, and/or counters)
- *Can be reused* as another material after discarding
- *Healthy flooring option*
  - Unlike carpets, tile:
    - Does not harbor dust, allergens, spores etc.

##### **Costs:**

- *Intensive project:* highly suggested to be done by a professional
- *Please refer to* the table on page 64

##### **Tips:**

- The tile is installed upon a sub-floor:
  - best suggested is concrete, but wood will work as long as it is in good condition (no warping, rotting, etc.)
  - if installing a sub-floor material, choose a FSC certified product
- Choose “green”, low to no-VOC products: grout, adhesives, etc.

- If choosing to hire professional installer for this project:
  - Start shopping for a professional before shopping around for tile:
    - This prevents not buying enough tile required for the project
    - You may be able to catch a discount for tile, as the professionals may order the tiles themselves, acquiring a discounted price
- Consider the future when choosing tile designs and colors:
  - This flooring has a long lifespan
    - Select a more neutral and flexible design so that when future redesigning/painting comes up it is easy to work around
- Be sure the tile is ‘glazed’
  - This helps with cleaning up spills, stain and odor prevention

### **Summary of Non-wood Flooring Options:**

#### **Benefits:**

- *Strong & Durable:* Bamboo is comparably strong and as durable as wood products
- *Less Expensive:* On average non-wood flooring options are cheaper per square foot of material than wood
- *Non-wood products* decrease pressure on forest resources
  - cork and bamboo grow faster than wood and regenerate after being harvested
- *Ceramic tile and linoleum* as the best choices while considering environmental and economic factors
- *Utility:* Cork is a soft flooring option;

#### **Costs:**

- *Shipped From Afar:* Cork is grown in North Africa, Europe so it needs to be imported- having a large carbon footprint

<b>Green Flooring</b>	<b>Cost (per sq. ft.)</b>	<b>Cost (per sq. ft. installed)**</b>	<b>Life expectancy of product (yrs.)</b>
Bamboo	\$3.35*	\$12	NA
Ceramic Tile/Recycled ceramic Tile (8"x8" tiles)	\$4.37	Recycled-content: \$10-33  (Conventional: \$13)	25-100
Cork	\$4.30*	\$10	30-40
Natural Linoleum	\$1.11-1.67	\$7	40
Wood	\$7.75	Reclaimed Wood: \$16	25-110
Green Carpet: Recycled Content & Wool	\$9-15	Recycled content: \$53 Wool: \$45-\$150 (conventional: \$57)	25-30

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\*Cost per square foot are averages made through HomeDepot<sup>23</sup> 2011-10-18

\*\* Data from "Green Home Improvement" by Daniel D. Chiras, 2008.

<sup>22</sup> Above table: Main source: U of MN, "Minnesota Green Affordable Housing Guide", [http://www.greenhousing.umn.edu/comp\\_flooring.html](http://www.greenhousing.umn.edu/comp_flooring.html); also, MPCA, "Finding green building products" provides a "product and company directories" including buildinggreen.com, which is where the bamboo information is sourced from.

<sup>23</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

## c. Green Carpeting

### Recycled Carpet:

#### **Benefits:**

- *Less Hazardous Vs. Conventional Carpet:* Off gassing or release much less indoor air pollutants and VOCs than do conventional petroleum-based carpeting
- *Comfort:* Provide warmth, especially during the cold winter months
- *Composed of recycled plastic bottles*
  - recycling saves energy, conserves raw materials for future generations, prevents materials from going to the landfill, reduces carbon footprints
  - is also available as recycled nylon
- *Readily available* in different colors and styles
- *Installation* is the same as installing conventional carpeting

#### **Costs:**

- *Not Advised:* The EPA (Environmental Protection Agency) advises to limit carpeting within the home. Carpeting may be a source of indoor air pollution and can “harbor mold spores, dust mites, dirt and allergy-producing substances”.
- *Releases toxic chemicals* and contributes to indoor air pollution
- *Harbors dust*, allergens, dust mites, pollen, spores, etc.
- *Difficult to clean* and keep clean
  - Can retain smells that are difficult to get rid of
- *Short life span*
  - Inevitably more expensive because of cleaning procedures
  - More frequent replacement compared to wood and tile flooring
- *Off-Gassing:* Many conventional carpeting is basically a petroleum product
  - These off-gas more than recyclable content or wool carpet
- *Toxic Material:* Backing on the carpet may be a toxic material
  - There are options for non-toxic backing options
- *Please refer to table on page 64*

**Tips:**

- check with manufacturers to be sure that the carpeting that you are considering does not contain:
  - formaldehyde, CFCs, PCBs, mercury, SB latex
  - non-toxic backing
  - green non-toxic carpet pad; also available composed of recycled content or natural content
  
- research and shop for options and ask questions to learn about the environmental standards applied by the manufacturers
  
- Also, consider wool carpets

**Summary for Green Carpeting:**

- Select non-carpeting and non-vinyl flooring options.
  - Vinyl was not referred to in green flooring options because it is a petroleum-based product. It is not a suitable sustainable home material and there are far better options available.
  - If a carpet is yet desired, use rugs; refer to the guidelines and relate to the benefits of carpeting for choosing a sustainable rug. Rugs can be versatile, attractive and manageable carpeting-alternatives, but, at a cheaper cost to install, maintain and clean. If small enough, they can be taken to the wash to clean, then air dry, to make like new.
    - Green Label certified floor coverings via CRI (Carpet & Rug Institute)
  
- Depending on area and location in the house (kitchen verse living or dining area), select a flooring material that is appropriate. Avoid buying the cheapest option; often times the cost reflects the durability of the product. A step towards sustainability involves selecting and investing in materials that have a long life span.
  
- Shop around for options at nearby twin cities ReStore, ReUse, and other salvage/reuse/surplus outlets
  - see what possibilities there are according to abundance of available product and space you need to have covered
    - be prepared and have your area measured before shopping for options
  - look up ‘salvage merchandise’ in the yellow pages
  - do some research and make phone calls if necessary

- When on-site and shopping for new materials, ask questions and get answers. If they are not providing you with the information you want (such as VOC or formaldehyde content, etc.) avoid buying products that are not labeled or cannot be discussed on their origins and its contents.

It is important to seek the information about where the product comes from so you can regulate the potential of products contributing to indoor air pollution

**Resources:**

- ReGreen, <http://www.regreenprogram.org/>.
  - result of collaboration between the American Society of Interior Designers (ASID) Foundation and the U.S. Green Building Council (USGBC)
    - provides various reliable resources and tools for green home implementations
- Minnesota Sustainable Housing Initiative
  - “Green Communities with Minnesota Overlay for Single Family”, <http://www.mnshi.umn.edu/kb/guidelines/gcs/gc.html>.
- University of Minnesota: Minnesota Green Affordable Housing Guide
  - [http://www.greenhousing.umn.edu/comp\\_flooring.html](http://www.greenhousing.umn.edu/comp_flooring.html).
- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).

## 2. Green Cabinetry

Most cabinets are made from particleboard or a similar material known as medium-density fiberboard (MDF). These materials are comprised of sawdust and wood shavings. The wood fibers in these cabinets are bonded together by a plastic resin, which contains formaldehyde. Other options are available that would reduce formaldehyde exposure. One example is custom ordering cabinets made from solid wood or PrimeBoard, an MDF substitute. This is made from wheat straw and non-formaldehyde-producing resin. Options also include purchasing low-VOC cabinetry in addition to high-recycle-content cabinetry, made from MDF board. Also, you can request the custom cabinetmakers use no-VOC products when staining and finishing your cabinets. You may also specify that your wood come from a sustainably harvested source. Many manufacturers of formaldehyde-free agriboard, particleboard, and MDF use a resin known as MDI (methylene diphenyl isocyanate). This resin does not out-gas hazardous chemicals in finished products like the others.

### **Benefits:**

- *Less Harmful:* Reduced exposure to harmful chemicals
- *Conserves Resources:* Reducing your use of virgin wood

### **Costs:**

- *More Expensive:* Two to three times as much as stock cabinets made from conventional materials

### **Tips:**

- To keep costs down while going green, purchase and refinish old cabinets from building salvage stores or use open shelving in place of some wall cabinets
- Find local retail outlets that carry green cabinetry and check out manufacturers' websites

### **Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).

### 3. Paints, Stains, & Finishes

Many conventional paints, stains, solvents, adhesives and other building products contain VOCs (volatile organic compounds) and other possibly harmful substances. VOCs are off-gassed or released into the air as an indoor air pollutant. One common source of VOCs is from formaldehyde. Exposure and concentration levels vary with products and indoor environments. Read the labels and ask questions if information is not clearly provided. According to the EPA (Environmental Protection Agency), indoor air is 2 to 5 times more polluted than outdoor air. In this section the focus is more on air quality and health while choosing paint products.

#### **Benefits:**

- *Availability:* no VOC and phthalates free containing paints, stains and finishes are readily available :
  - at large retail stores such as Home Depot<sup>24</sup>
  - Sherwin-Williams is dedicated to reducing negative effects on the environment. They provide “Green Solutions” and LEED (Leadership in Energy and Environmental Design)
  - Glidden, Devote Paint/Wonder-Pure, Safecoat, and many other brands are broadening this market
  
- *Decreases health concerns* within the home, providing a sense of security

#### **Costs:**

- *Purchase:* no-VOC paints are slightly more expensive
  - for locality purposes, a cost comparison at Home Depot for a flat, interior paint yields a non-VOC paint (YOLO) is more expensive than a VOC-containing paint (Behr): \$35.95 vs. \$22.96.
  - please note this price comparison is a generality and may not apply to all suppliers and may change in near future
  
- *Priming:* No or low VOC paints generally require or at least suggest a primer before painting unlike VOC-containing paints that are available as a primer and paint in one

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<sup>24</sup> \*Disclaimer: Identification of suppliers and home improvement stores does not imply endorsement. There are many options for services and supplies suggested in this section of the guide, and the ones listed here are merely a suggestion. \*

**Resources:**

- “Green Remodeling: Tips for Minnesota Homeowners”  
<http://www.pca.state.mn.us/index.php/view-document.html?gid=10644>.
- Environmental Protection Agency (EPA), “Indoor Air Pollution: An Introduction for Health Professionals”,  
<http://www.epa.gov/iaq/pubs/hpguide.html#VOCs>.
- Green by Design: How to plan and build healthy, sustainable affordable housing and communities in Minnesota: Resource list:
  - <http://www.mngreencommunities.org/publications/download/resources.pdf>.
- MPCA (MN Pollution Control Agency): Green Building (suggested sources PDF)
  - <http://www.pca.state.mn.us/index.php/view-document.html?gid=4465>.
- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).

## **SUSTAINABLE LANDSCAPING**

Conventional landscaping provides many homeowners an aesthetically appealing property. However, conventional landscaping can require the owner time and money to maintain and unfortunately lead to negative impacts to the surrounding environment. Large lawns, for example, can call for a large amount of water and the use of fertilizers, pesticides, and herbicides, which becomes very economically demanding. Sustainable landscaping provides an alternative to conventional methods and addresses economic, environmental, and educational benefits for the homeowner that conventional methods do not. Landscaping with a focus on the sustaining the natural environment is beneficial to not only the quality of the homeowners' land, but also the surrounding environment. These projects will help benefit the residents of Richfield making the city more sustainable for future generations.

### **This section includes:**

1. Tips for Sustainable Landscaping
2. Native Species
3. Trees: Shade and Wind
4. Rain Gardens
5. Rain Barrels
6. Composting
7. Permeable Surfaces
8. Mulching
9. Green Roofs
10. Environmentally Friendly Roofing Alternatives

## 1. Tips for Sustainable Landscaping

Converting a conventional landscape to a sustainable one will require many changes and different management techniques. These tips will allow you to maintain your lawn and help save money, while reducing your impact on the environment.

- *Mowing:* Conventional landscaping requires lawn mowing, and homeowners with power mowers will incur fuel costs. Conventional lawn height in the Twin Cities area is about 1 inch. Cutting lawns that short will increase the rate of runoff that can damage surrounding water sources as well as increase the presence of weeds. Letting your grass grow to a length of 3 inches will allow for plants to root deeper and increase the rate of infiltration.
  - Consider switching to push or electric mowers to reduce the need for fossil fuels. Push mowers can cost \$75-\$300 and electric mowers can run anywhere from \$135-\$5,000.
- *Leave grass clippings:* Many people remove grass clippings after mowing the lawn. Leaving them on your property has similar result to chemical fertilizers, allowing you to reduce your cost on purchasing these items. By keeping the grass clippings on your property you are returning those plants nutrients so they are available for future plants. Impervious surfaces, such as sidewalks and driveways, should still be swept to reduce the contamination of watersheds.
- *Watering:* Do not over water. Watering your landscape should only occur if it has not rained for at least a week. Plants and grasses in Minnesota are able to withstand the diverse weather, including drought.
  - *Water in the morning* when it is cool. Evaporation rates are much higher during the middle of the day. This will also help reduce the spread of disease within the grass and other yard vegetation.
  - *Water slowly and close to the ground.* By watering like this the roots of grasses will be able to develop to help insure a healthy lawn. Watering too much will actually slow down the development of your lawn.
  - *Install a rain barrel* to help reduce the cost of water bought from utilities. See the “Rain Barrel” section for more details.
- *Fertilizers and Pesticides:* Many plants do not require a heavy chemical load. Using fertilizers and pesticides to create a healthier yard, can poison the surrounding environment. There are ways in which you can reduce the need for the additives and help protect your landscape:

- *Plant Native Species:* Use native grasses and perennials. They do not need fertilizer. See “Embrace Native Species” section for more details.
- *Test your soil:* Test your soil before you fertilize. Many times your lawn may not need broad-spectrum fertilizers, and testing the soil will tell you exactly how much to amend your soil. You can get your soil tested for free at the University of Minnesota Soil Testing Laboratory and find out more information on fertilizer use.
  - <http://soiltest.cfans.umn.edu/>
- *Plan before you Plant:* Understand what you are planting and what its capabilities are before you plant. This includes knowing where in your yard certain plants will be able to grow. Know the maximum sizes plants and trees will reach, and how to maintain them.

### Resources

- “Beneficial Landscapes: Green Communities,” *US Environmental Protection Agency*, modified 3 October 2011, <http://www.epa.gov/greenkit/landscap.htm>.
- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Greenacres: Landscaping with Native Plants,” *Great Lakes: US Environmental Protection Agency*, modified 14 November 2008, <http://www.epa.gov/greenacres/toolkit/index.html>.
- “Sustainability,” *City of Burnsville, Minnesota*, accessed 2 October 2011, <http://www.ci.burnsville.mn.us/index.aspx?nid=842>.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.
- “Yard Care Tips,” *City of Roseville, Minnesota*, accessed 2 October 2011, <http://www.ci.roseville.mn.us/index.aspx?NID=540>.

## 2. Plant Native Species

Minnesota is home to a variety of native species; including trees, shrubs, ground covers, ornamental plants, native grasses, and wild flowers. Often these amazingly beneficial plants are over looked for more exotic and invasive species.

### Benefits:

- *Improves Water Quality:* Native plants do not require chemical use and extra watering that many non-native plants do. This reduces chemical loading from runoff and improves water quality in the surrounding area.
- *Improves Air Quality:* Many non-native species require maintenance equipment that is powered by either battery or gasoline that gives off air pollutants when used.
- *Decreases erosion:* Native plants are adapted to Minnesota's weather and have deeper root systems that provide lawns with erosion control.
- *Saves Time and Money:* Native plants require minimal maintenance, eliminating fuel and pesticides, allowing money savings and avoiding polluting. The Environmental Protection Agency (EPA) states that in a ten year time period, installing and maintaining native landscapes will help save a homeowner one fifth of the total costs as a conventional landscape. Here are some average costs of conventional landscaping:
  - Lawn Cut: \$20-40 per 1/2 acre per cut
  - Weeding: \$25-50 per month
  - Trimming: \$175-400
  - Chemical care: \$400-700 per year
- *Increased Property Value:* Minnesota Pollution Control Agency (MPCA) states many studies show increased value with natural and native landscapes over conventional ones.

### Costs:

- *Varying Price:* Exact price will depend on how many and what types of plants are selected.

### Tips:

- *More information* about what plant species fit best can be found at the University of Minnesota's Extension Gardening program.
  - <http://www.extension.umn.edu/garden/>

**Resources:**

- “Beneficial Landscapes: Green Communities,” *US Environmental Protection Agency*, modified 3 October 2011, <http://www.epa.gov/greenkit/landscap.htm>.
- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Greenacres: Landscaping with Native Plants,” *Great Lakes: US Environmental Protection Agency*, modified 14 November 2008, <http://www.epa.gov/greenacres/toolkit/index.html>.

### 3. Trees: Shade & Wind

Shade trees provide benefits both ecologically and economically when utilized properly. Native trees found within Richfield each play a significant role in reducing cost and benefiting the environment.

#### Benefits:

- *Provide Shade for the Home:* Shade trees may allow less reliance on air conditioning during the hot summers. Depending how effective your energy-efficient landscaping is, you could gain savings of 10% to 25% on your heating and cooling bills.
- *Provides shade on paved surfaces:* Trees can lower the air temperature by providing shade to paved areas from the sun's heat, reducing what is known as the "urban heat island effect."
- *Provide Windbreak:* Shade trees can help protect homes from harsh winds, which may reduce heating costs during winters.
- *Increased Water Quality:* Like many native plants, trees are able to slow down water flow and infiltrate run-off before it enters our water sources. This also reduces the risk of soil erosion and helps reduce the risk of flooding.
- *Cleaner air:* Trees are a source of oxygen on our planet and help reduce the amount of carbon dioxide and other air pollutants through sequestration.
- *Curb Appeal:* Trees planted on your land can enhance the beauty of a home and community, as well as provide a habitat to many bird species.

#### Costs:

- *Maintenance:* Some trees may require trimming or pruning in order to create a safe environment for the residents. Minnesota Department of Natural Resources estimates total maintenance per tree is about \$8-\$36/year.
- *Purchasing & Planting:* Trees can be expensive depending on the species. The type and size/age of tree when purchased could range, so consult a local tree farm with more precise price range.

#### Tips:

- *Consult an arborist* or city official with specific questions in order to insure proper attention and safety.

- *Planting for shade:* Shade trees are generally planted on the south and west sides of homes, where most sunlight occurs.
- *Planting for windbreak:* Trees used for windbreak are generally planted on the north and west sides of the home.
- *Contact* the University of Minnesota’s Sustainable Urban Forestry Information series to find out what species of trees fit your unique landscape.
  - <http://www.sustland.umn.edu/index.htm>

**Resources:**

- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Greenacres: Landscaping with Native Plants,” *Great Lakes: US Environmental Protection Agency*, modified 14 November 2008, <http://www.epa.gov/greenacres/toolkit/index.html>.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.

## 4. Rain Gardens

A rain garden is a depression in the landscape planted with a diverse mix of native plants, like grasses and wild flowers, and is used to reduce the amount of storm water runoff by increasing infiltration rates. Rain gardens will reduce the risk of poor water quality while providing aesthetic appearances.

### Benefits:

- *Erosion Control:* Rain gardens decrease erosion with deep-rooted plants that stabilize the soil and provide flood control during storms.
- *Increase Water Quality:* The deep roots of the select plants in rain gardens catch storm water and runoff that often carries large amount of nutrients and pollutants that normally wash into the sewer or watershed. They also decrease the chances of flooding and help recharge ground water aquifers.
- *Embrace Native Diversity:* It is important to use a mix plant species to provide resistant from things like insects, floods, or disease. These plants are also adapted to the weather conditions here in Minnesota (see Embrace Native Species section) and provide a pleasing appearance.
- *Minimal Maintenance:* Rain gardens require minimal watering and maintenance other than initial establishment.

### Cost:

- *Installation:* Each rain garden will vary in cost and will depend on a variety of variables. They include:
  - *Plants:* Plants will vary in cost depending on the area in which your garden is placed (i.e. amount of shade/sun, soil type and condition).
  - *Labor:* Cost will depend on whether homeowners complete the project or contract help.
  - *Tools:* Typically requires basic gardening tools (i.e. shovel, spade, etc.)
  - *Debris Removal:* This includes soil and sod removal, as well as any other materials (such as sidewalks and plants), which is a one-time removal.
  - *Costs on average* per square foot on your own is \$3-\$5 and for contract help \$10-\$15.

**Tips:**

- For more information on the benefits of rain gardens look into the Minnesota Department of Natural Resources.
- Visit and contact Metro Blooms to find out more and how-to guides on rain garden installation.
  - <http://metroblooms.org/index.php>

**Resources:**

- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Greenacres: Landscaping with Native Plants,” *Great Lakes: US Environmental Protection Agency*, modified 14 November 2008, <http://www.epa.gov/greenacres/toolkit/index.html>.
- “Rainwater Gardens,” *City of Maplewood, Minnesota*, accessed 2 October 2011, <http://www.ci.maplewood.mn.us/index.aspx?NID=456>.
- Thompson, J. William and Sorvig, Kim, *Sustainable Landscape Construction*, Washington D.C.: Island Press, 2008.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.

## 5. Rain Barrels

Rain barrels offer residents an alternative that can be both beneficial for the environment and your pocketbook. Watering lawns is so common that it often goes under the radar as a wasted resource, costing hundreds of dollars in water bills. Rain barrels connect to the homes down spout and collect the roof run off and store this water that can be used for watering your lawn and other plants.

### Benefits:

- *Reduce Cost:* Rain barrels are an easy fix and can help reduce the amount spent on water bills.
  - *Saves* approximately 1,300 gallons of water during the peak months of summer.
- *Conservation:* Using the water from the rain barrel is completely free and will help reduce the amount of wastewater.
- *Water Quality:* The water within the rain barrel is naturally soft and free from chemicals and nutrients many faucets have. This makes it better suited for plants.
- *Easy to Build:* Once assembled, no other alterations are required.

### Costs:

- *Materials:* Cost of rain barrels depends upon which type you will purchase. Can range anywhere from \$50 to \$1600. However once installation is done and you will no longer need to spend money on water from the local utility. These barrels can be found at nearly all home-improvement stores.

### Tips:

- *Check out* the University of Minnesota Extension system to find out more. <http://www.extension.umn.edu/environment/00023.pdf>.

### Resources:

- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Environment,” *St. Louis Park, Minnesota*, modified 21 September 2011, <http://www.stlouispark.org/environment.html>.

- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.
- “Yard Care Tips,” *City of Roseville, Minnesota*, accessed 2 October 2011, <http://www.ci.roseville.mn.us/index.aspx?NID=540>.

## 6. Composting

Home composting can be a good way to utilize both yard waste (grass clippings, leaves etc.) and food waste. Composting can provide residents with a naturally nutrient rich substance that can be used in your garden in replacement of chemical fertilizers and water use. This waste can either be placed in a compost pile or within a compost bin.

### Benefits:

- *Reduce Waste:* Composting helps reduce household waste by one-sixth.
- *Saves Money:* Instead of using and purchasing conventional fertilizers, composting utilizes what was formally known as waste into a beneficial material.
- *Fertilizer Alternative:* Compost provides nutrients that can be used within any home garden, replacing chemically dense supplements. This has benefits to the environment as well by decreasing the use of chemicals in runoff.
- *Enhances Soil:* Compost increases the solid capability of retaining nutrients and water. The layer of organic material creates a better growing environment for plants. Organic compost also attracts beneficial organism that will help enhance the soil and reduce its chances of solidifying.
- *Easy to Use:* Home composting can be collected both in and outdoors and in any living quarters.

### Costs:

- *Compost Bins:* The practice of composting is virtually free unless you are interested in purchasing a compost bin. Compost bins can range in both size and price from \$35-\$550 and can be purchased at a variety of different home improvement retailers.

### Tips:

- Minnesota Pollution Control Agency's Home Composting page. <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden/start-composting-in-your-backyard.html>.
- University of Minnesota's Extension Service. <http://www.extension.umn.edu/>.

**Resources:**

- “Beneficial Landscapes: Green Communities,” *US Environmental Protection Agency*, modified 3 October 2011, <http://www.epa.gov/greenkit/landscap.htm>.
- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- Thompson, J. William and Sorvig, Kim, *Sustainable Landscape Construction*, Washington D.C.: Island Press, 2008.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.

## 7. Permeable Surfaces

Some of the most damaging environmentally issues are related to water runoff carrying pollutants and nutrients that can enter local water systems as it crosses hard surfaces such as driveways and rooftops. Switching to more permeable surfaces can reduce the rate of runoff and increase infiltration rates benefiting your surrounding environment. Some examples of permeable surfaces include rain gardens, green roofs, concrete grid pavers (CGP), pervious concrete (PC), and permeable interlocking concrete pavers (PICP).

### Benefits:

- *Increased Water Quality:* Permeable surfaces help increase water quality by allowing water to percolate through the surface, decreasing the introduction of chemicals and nutrients into surrounding watersheds.
- *Increased Aesthetics:* This will provide your home with added value and separate it from the traditional surfaces so common within the Metro Area.

### Cost:

- *Construction:* Introducing or altering current paved surfaces can be relatively expensive. Price is dependent on how large of a surface you would like to make permeable.
- *Costs:* Alternative materials, per square foot: (costs are national averages and do not include sales tax)
  - Concrete pavers: \$11.50
  - Gravel, 6" thick: \$.85
  - Paving stones, 2" thick: \$26.50
- *Installation* will vary depend on whether it's a do it yourself project or though contract help.

### Tips:

- *For more information* visit [www.perviouspavement.org](http://www.perviouspavement.org) or [www.paversearch.com](http://www.paversearch.com) and click *Permeable Pavers*.
- Gravelpave made by the company Invisible Structures Inc., can be used for driveways and parking areas. It is made up of plastic rings in grid like porous geotextile fabric. Check out the company's website for photos of various applications:
  - <http://www.invisiblestructures.com>

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- “Heat Island Effect: Green Roofs,” *US Environmental Protection Agency*, modified 23 February 2010, <http://epa.gov/heatisland/mitigation/greenroofs.htm#3>.
- “Permeable Surfaces,” *City of Minneapolis, Minnesota*, accessed 15 October 2011, <http://www.ci.minneapolis.mn.us/sustainability/permeable-surfaces.asp>.
- Thompson, J. William and Sorvig, Kim, *Sustainable Landscape Construction*, Washington D.C.: Island Press, 2008.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.

## 8. Mulching

Another way in which you can enhance your yard in an environmentally sustainable way is to use mulch in your gardens. Mulch is broken down organic waste that usually comes in the form of wood chips or shredded wood, but can include leaf litter from nearby trees. The substance is used to help protect and insulate ground plants.

### Benefits:

- *Soil Protection:* Mulch provides an extra layer of organic material that can help improve infiltration rates and protect against excess weathering from harsh conditions such as severe storm events. Mulch also acts as a layer of insulation for the soil from the varying temperatures Minnesota and also helps protect soil from diseases. The material that makes up mulch provides the soil with extra nutrients and helps increase the rate of aeration.
- *Saves Time:* Once the mulch is laid it will reduce the amount of weeding and other maintenance. The layer of mulch prevents the spread or growth of weeds and reduces the need of using tools that cause safety issues.
- *Reduce Waste:* Allows for homeowners to recycle yard waste into a beneficial material.
- *Aesthetically Pleasing:* Mulch helps provide your yard with a universal cover that can hide unwanted pieces of land, which increases the aesthetic value of the entire landscape.

### Cost:

- *Purchasing:* Many times mulch can be free at tree farms or municipal areas. You can make your own mulch from your own yard waste (fallen leaves, branches, etc.) with the use a wood chipper/shredder.
  - *Rental Equipment:* range from \$80-\$300 depending on sizes and how long they will be in use. These can be found at local hardware stores or rental equipment establishments.
- Commercially produced wood and bark chips will be priced on quality and type of material used.
  - \$10-\$30 per cubic yard

### Tips:

- Find out more at the University of Minnesota Extension.
  - <http://www.extension.umn.edu/>

**Resources:**

- “Beneficial Landscapes: Green Communities,” *US Environmental Protection Agency*, modified 3 October 2011, <http://www.epa.gov/greenkit/landscap.htm>.
- “Earth-Friendly Home Landscaping Guide,” *Hennepin County Environmental Services*, accessed 15 September 2011, <http://www.hennepin.us/portal/site/HennepinUS/menuitem.b1ab75471750e40fa01dfb47ccf06498/?vgnextoid=f6570678f3933210VgnVCM10000049114689RCRD>.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.
- “Yard Care Tips,” *City of Roseville, Minnesota*, accessed 2 October 2011, <http://www.ci.roseville.mn.us/index.aspx?NID=540>.

## 9. Green Roofs

Green roofing is another way to make both your home and landscape more sustainable. A green roof alters traditional roofing techniques and replaces with either partial or full vegetation cover. Converting a standard roof to a green roof could require structural change, but has benefits that will be able to help improve the environment and help reduce costs at home.

### Benefits:

- *Increased Water Quality:* Green roofs reduce the amount runoff and help capture many nutrients.
- *Decrease in Energy Use:* Green roofs reduce the cost of both heating and cooling the home by acting as insulation.
- *Increased Air Quality:* With the decrease in energy costs, homes will emit less greenhouse gases. Green roofs capture more pollutants, enhancing the quality of life.
- *Aesthetic Value:* Green roofs can add to the homes' value and help increase the aesthetics of your property and community. The new vegetation also can provide habitat to many bird species.
- *Less Maintenance:* Although an initial investment is more expensive at first, the life spans of green roofs are much longer than conventional roofing.

### Cost:

- *Cost:* According to the EPA, installation of a green roof can cost \$10-\$25 per square foot. The cost will be dependent on the style and plant selection.
- *Maintenance,* annually to the roof is \$.75-\$1.50 per square foot.
- *Converting to green roofs* may require restructuring of old homes in order to support weight change.

### Tips:

- Contact the Minnesota Green Roofs Council for more information <http://www.mngreenroofs.org/>.
- Minnesota Pollution Control Agency provides a how to for green roofs <http://stream2.video.state.mn.us/mnoet/Viewer/?peid=3119b1e739e441628abe1326bdf63384>.

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- “Heat Island Effect: Green Roofs,” *US Environmental Protection Agency*, modified 23 February 2010, <http://epa.gov/heatisland/mitigation/greenroofs.htm#3>.
- Thompson, J. William and Sorvig, Kim, *Sustainable Landscape Construction*, Washington D.C.: Island Press, 2008.
- “Yard and Garden,” *Minnesota Pollution Control Agency*, modified May 2011, <http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/yard-and-garden.html>.

## 10. Environmentally Friendly Roofing Alternatives

Here are some alternatives to traditional roofing materials that provide homeowners with economic and environmental benefits.

- Recycled-Content Shingles
  - Most popular of all roofing products
  - Shingles made from recycled waste materials including plastic, rubber, and wood fiber
  - Using post-consumer and post-industrial waste reduces the demand for natural resources
  - Lowers energy consumption and reduces pollution
- Metal Roofing
  - Offer extreme durability and fire resistance
  - Ideal roofing choice for homeowners who wish to collect rainwater from their roofs to water their landscapes (See Rain Barrel and Green Roof sections for more information).
  - Metal roofing can be recycled at the end of its life.
- Rubber Roofing
  - Recycled material made from the belts of old steel belted radial tires

### **Benefits:**

- Added home value
- Remain intact for a longer duration of time. Green roofing will outlast two or three conventional roofs
- Many green roofing products come with 50-year warranties

### **Cost:**

- Green roofing products will generally cost more than mass produced asphalt shingles (possibly two to four times more).

### **Tips:**

- Find out more about the benefits at:
  - <http://www.doitgreen.org/article/home/EcoRoofing>

**Resources:**

- Daniel D. Chiras, *Green Home Improvement* (Wiley, John & Sons, Incorporated, 2008).
- Thompson, J. William and Sorvig, Kim, *Sustainable Landscape Construction*, Washington D.C.: Island Press, 2008.